The Mining Magazine

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EDITORIAL

IN its customary "Statistical Review of the World Oil Industry" the British Petroleum Company points out that published estimates of proved reserves for the world increased only slightly in 1960, the biggest revision occurring in the U.S.S.R., where the estimated reserves were increased by 11%. World oil production, however, rose by 7% over the 1959 level to 1,079,000,000 tons, the main increase coming from the Middle East. Demand for oil during 1960 rose by 8%, slightly above the trend of the past five years, the increase being mainly in Western Europe and Japan.

COMPARATIVE costs of roof bolting and conventional timbering under similar bituminous coal-mining conditions are analysed by the United States Bureau of Mines in a report recently released,[1] the information in the report being based on the Bureau's study of 14 representative mines in Pennsylvania, Ohio, and West Virginia. It is recalled that roof-bolting has supplanted conventional timbering in most of the larger and more productive coal mines of America in the past ten years. In fact it has replaced timbering in 13 of the 14 mines studied in the report, primarily because of its many advantages in safety and convenience. Among other benefits credited to the use of such bolts were additional headroom to accommodate larger equipment and to enable rapid movement of equipment and a reduction in the amount of cleaning plant reject.

SYMPOSIA arranged by the University of Minnesota include one to be held in Duluth from January 15 to 17 next at which some 20 papers are to be read covering the beneficiation and agglomeration of taconites, magnetic roasting, and metallized pellets, blast-furnace performance with agglomerates, and new developments in the exploration, mining, and beneficiation of iron ores. Some 750 engineers engaged in the iron-ore mining industry are expected to attend. Later in 1962, from May 3 to 5, the University is holding its 5th Rock Mechanics Symposium, jointly sponsored with the Colorado School of Mines, the Missouri School of Mines and Metallurgy, and Pennsylvania State University. Papers for that function are now being solicited, all details being available from the Center for Continuation Study at the University of Minnesota, Minneapolis 14.

[1] *Information Circular* 8024, "Costs of Mining Under Bolted Roof and Timbered Roof in Bituminous Coal Mines," by M. J. Ackerman and J. J. Wallace. Copies can be obtained from the Publications Section, U.S. Bureau of Mines, Pittsburgh 13, Pa.

THE International Tin Council in its fourth annual report [1] covers a period which was primarily one of export control. While restriction of exports from the main tin-producing countries was in operation for the whole year but on a modified scale—for example, 25,000 tons in the quarter July–September, 1959—it was almost back to normal at 37,500 tons in April–June, 1960. The Buffer Stock was in general a seller, if not on a large scale, during the year, either on its own account or on account of the United Kingdom stockpile, although tin prices in London, New York, and Singapore were remarkably steady. Supplies from the U.S.S.R. and China were beginning to fall. At June 30, 1960, the Buffer Stock held over 10,000 tons of metal and over £11,000,000 in cash. The report contains a detailed summary of the provisions of the Second International Tin Agreement drawn up in New York in 1960, which came into force on July 1, 1961.

IN his Report for 1960 H.M. Chief Inspector of Mines refers to the fact that "stalemate" has apparently been reached in regard to the number of serious accidents in mines, while the number of fires in coal mines is still increasing—76 in 1960 compared with 71 in 1959. He considers that better standards of installation, maintenance, and cleanliness of apparatus and machinery would do much to reduce the number of incidents. The Chief Inspector also regrets that the amount of water infusion of coal, often the most effective dust prevention measure because it wets the coal before it is worked, has declined in favour of other dust prevention measures which aim at suppressing the dust after it has become airborne. More attention should be given, he suggests, to deep-hole water infusion with the aim of infusing, in one operation, sufficient coal for a week's face advance. While there were no fatal accidents caused by electricity during the year, he considers that standards of illumination below ground could be considerably improved merely by cleaning the glass on

[1] London: International Tin Council. Price 7s. 6d., post free.

lighting fittings and by whitening the roof and sides of working places. He is of the opinion that if more attention were paid to these matters, and to the careful siting of fixed lights, the resulting improvement in lighting standards would bring about a reduction in the number of accidents, particularly those connected with haulage and transport.

Geological Work in Great Britain

Published at the beginning of September the 1960 report of the Geological Survey and Museum [1] records substantial progress in detailed geological mapping throughout the United Kingdom. The Department of Scientific and Industrial Research draws attention to the fact that as an outcome of this work some discoveries of economic significance have been made. To the vast additions made to this country's reserves of salt resulting from exploration in the Cheshire Basin attention was called in the MAGAZINE for August, 1960, while last month note was taken of the discovery of coal in a borehole at Apley Barn, Witney, about 10 miles from Oxford. Now can be recorded the result of some boring work in Northern Ireland. The Geological Survey of Northern Ireland, established in 1947, is closely integrated with that of Great Britain and following legislation by the Parliament of Northern Ireland enacted in December, 1959, the two Surveys have now similar statutory powers—such as, access to land and to information from mines and bore-holes. A hole put down to a depth of 600 ft. at Avoniel, in East Belfast, to test the opinion, suggested by surface mapping and old records of boring for water, that anhydrite or gypsum itself might be present in commercial quantities was completed early in 1960. In this hole a massive bed of anhydrite was encountered in Permian Marls between 365 ft. and 381 ft. below surface. At the same time detailed mapping of other areas has been expedited, while the Survey's Geophysical Department, based on London, completed measurements of the regional variations in the force of gravity and of the intensity of natural magnetic forces (using an airborne magnetometer for the latter) over the whole of Northern Ireland, reflexion seismic methods being used to survey the sub-basalt rock.

[1] " Summary of Progress of the Geological Survey of Great Britain and the Museum of Practical Geology for the year 1960." London: H.M. Stationery Office. Price 5s. 5d., post free.

In the year under review another of the Survey's specialist departments, the Atomic Energy Division, was mainly concerned in furthering the beryllium assessment programme of the Atomic Energy Authority. Work was undertaken principally in Southern Rhodesia and East Africa. The beryllium monitor developed at Harwell was also used in Nigeria, where the occurrence of danalite in greisen zones of the Younger Granite ring complexes was investigated. At the same time considerable exploration has been going on in the United Kingdom, where extensive car-borne scintillometer work has been undertaken, so far without revealing any significant uranious mineralization. It can be noted, however, that with the lessened interest in uranium now that sufficient reserves have been established the work of this department of the Survey has decreased and some of its geologists have been transferred to other activities.

In the Geophysical Department the problems investigated during the year showed considerable variety. Regional aeromagnetic surveys by contract were continued over Wales, the adjacent Irish Sea, and part of the Bristol Channel.[1] Altogether 16,200 miles were thus covered at 1,000 ft. above terrain along north–south traverses 2 km. apart and perpendicular tie-lines at 10 km. In the Harlech area it is noted that magnetic values fell sharply across the coast towards a broad south feature in Cardigan Bay. East–west anomalies were located over Pembrokeshire and the northern part of the Bristol Channel, while north-west of Anglesey elongated negative anomalies noted suggest reversely-magnetized dykes trending towards a centre west of the Isle of Man. Other geophysical surveys by contract included those made through sections of survey boreholes at Wilkesley and Witney, where further drilling has taken place since, as mentioned above and recorded in the MAGAZINE for August. Electrical logs were also recorded in the Rookhope (County Durham) borehole being drilled for the University and sponsored by the D.S.I.R.

Mining in Western Australia

Speaking at the 60th annual general meeting of the Chamber of Mines of Western Australia, held in Kalgoorlie on May 30 last, Mr. L. E. Elvey, who succeeded the late Mr. R. J. Agnew as President of the Chamber,

[1] See also THE MINING MAGAZINE, August, 1961, pp. 92–94.

found it difficult to understand why it should be the policy of the Commonwealth Federal Government only to grant assistance towards the maintenance of existing gold production, when in other spheres the authorities are so conscious of the need for additional employment and export revenue. The Chamber is to take every opportunity vigorously to press its case for more liberal assistance to the gold-mining industry. On June 10 last year, he said, submissions were made to the Government regarding certain provisions of the Gold-mining Industry Assistance Act and those submissions are still under Treasury consideration. The Chamber considers that the general incidence of the Act is too narrow to maintain what was once a virile and expanding industry, which " under the present conditions of rising costs is in a state of gradual contraction." In particular, the president said, financial assistance is required to accelerate exploration and development.

During 1960 Western Australian mines treated 3,056,444 long tons of ore for a yield of 869,966 fine oz. of gold, valued at £13,593,225 in Australian currency. As compared with the previous year the gold yield was 8,997 oz. more, while the ore treated was up by 97,242 tons, the recovery averaging 5·69 dwt. a ton, against 5·82 dwt. The president drew attention to the continuing production of various minerals by companies associated with the Chamber. Pyrite from Norseman Gold Mines N.L., copper concentrate from Marble Bar and Ravensthorpe Copper Mines N.L., and asbestos fibre from Australian Blue Asbestos, Ltd., at Wittenoom Gorge, made a significant contribution to export earnings, which it is hoped will be further increased by expansion of their activities and by exports of bauxite from Western Aluminium N.L. During 1960 three trial shipments of bauxite of 10,000 tons each were mined and despatched to Japan by Western Aluminium N.L. and future activities will in a measure depend on the results of tests on this material.

United States Lead in 1960

Figures issued by the United States Bureau of Mines show that during 1960 the operating properties produced 246,700 short tons of recoverable lead, the lowest domestic mine output reported since 1900. Production increased slightly through the first quarter, declined through the second quarter, turned upward in August, and then declined through the remainder of the year, labour strikes in the Coeur d'Alene region of Idaho, beginning in May, 1960, reducing national output 10% during the last six months of the year.

The four largest producing States were Missouri, 111,900 short tons, Idaho, 42,900 tons, Utah, 39,400 tons, and Colorado, 18,100 tons for a total of 212,300 tons, 86% of the United States output. Missouri retained its place as the largest lead-mining State, the output from the mines of the Southeast Missouri Lead Belt representing about 45% of the total ; this was 6% above the 1959 figure. Idaho retained its position as the second largest producer and as the largest in the Western States, its output, however, representing a decline of 31% from the 1959 total. The decrease was attributable largely to the seven-month strike which closed the Bunker Hill and American Smelting and Refining mines in the Coeur d'Alene region. The remaining 14% of the lead output came from 15 States, the major producers of this group with a combined output of 23,100 tons, about 9% of the total output, being Arizona, Washington, Montana, and New Mexico. States east of the Mississippi River, California, and Nevada of the Western States, and Wisconsin, Kansas, and Oklahoma of the Mississippi Valley lead-zinc region accounted for the remaining 5%.

Domestic primary lead smelters and refineries in 1960 produced 387,200 tons of refined lead and 28,700 tons of lead in antimonial lead. Lead content of primary raw materials consumed was 425,900 tons ; that of scrap was 34,100 tons. Domestic ores were the source of 60% of the 382,400 tons of refined lead produced from primary sources, while foreign ores and bullion supplied 40% (66% and 34% respectively in 1959). Primary lead smelters also produced 4,800 tons of refined lead from scrap and secondary smelters 143,400 tons from scrap, the refined and remelt lead from all sources being 530,700 tons.

The Bureau goes on to say that the world production of lead in 1960 was essentially equal to that of 1959, as voluntary curbs on output by some of the major free-world producing countries, and United States import quotas, continued in force. World smelter production was estimated at 2,600,000 short tons and free-world consumption at 2,400,000 tons, resulting in a further increase in stocks. This balance in supply and demand was one of the major problems of the free-world lead industries.

MONTHLY REVIEW

Introduction.—In view of Britain's approach to the Common Market particular interest attaches to this month's meeting of the Commonwealth Finance Ministers' in Accra. In spite of the existing tension created by the Berlin situation trade prospects seem brighter at present than for some time past, possibly in the light of the positive recovery under way in the United States.

Southern Africa.—The output of the gold mines of South Africa during July totalled 1,889,248 oz., making with 34,977 oz. from outside producers a return of 1,934,225 oz. for the month, which constitutes a new record output. At the end of July there were 389,255 natives at work in the gold mines, as compared with 392,591 at June 30.

At the annual meeting of STILFONTEIN GOLD MINING held on June 13 in Johannesburg shareholders were informed that reef development is expected to commence in the Toni shaft area towards the end of the current year and that the Scott shaft is the final surface shaft to be sunk. Serious water problems should not be encountered in the Scott shaft. In the area of the Margaret shaft the zone of low values has been defined and there has been an improvement in development results in all directions from this zone.

At an extraordinary meeting of the NEW KLEINFONTEIN COMPANY to be held later this month it is to be proposed that the capital be reduced to R1,735,000 by the return of R1 per share. If the proposal is approved by the Court it is intended to make an initial return of 10 cents a share later this year.

Shareholders of WINKELHAAK MINES were informed at the end of August that borehole W.S. 39, situated some 9,000 ft. north of No. 2 shaft and 1,700 ft. in from the eastern boundary of the lease area, intersected reef at 5,333 ft. with the following results: Original intersection, 65·06 dwt. over 25·9 in.; deflection 56·32 dwt. over 26·6 in. Core recovery was complete in the original intersection and in the deflection and the hole has now been stopped.

It has been announced that a tube mill weighing 200 tons has been installed at the Vereeniging works of STEWARTS AND LLOYDS (S.A.). The mill cost R600,000 and has a total maximum capacity of 15,000 tons a month. It will produce light and heavy gauge welded tubing, ranging from 2 in. to 8 in. The mill is equipped with a very high frequency (450,000 cycles per sec.) welding head, capable of welding both low and high tensile as well as alloyed tubing, it is stated, and tubes from 9 ft. to more than 40 ft. in length can be produced.

On the Bechuanaland border a large new coalfield is being opened up by ISCOR, the State-owned steel company. The field is about 75 miles north of the iron-ore workings at Thabazimbi and 60 miles from rail head. The new area is about 48 miles by 21 miles in extent and the coal is said to be thick.

The directors of FREE STATE GEDULD MINES announced earlier this month further deflected borehole results on the farm Arrarat, in the south-eastern portion of the mine's lease area. In an original hole, A.R. 5, the Basal Reef was intersected at 7,479 ft., assaying 63·3 dwt. of gold per ton over a corrected width of 5·54 in. A deflection showed that the Reef was duplicated by a reverse fault and it was intersected at 7,479 ft. and again at 7,540 ft. The value in the upper intersection was 34·4 dwt. of gold per ton over a corrected width of 4·99 in. and the value in the lower intersection was 14·9 dwt. of gold per ton over a corrected width of 8·46 in. It was decided at the time, the company states, that, because the borehole had deviated considerably from the vertical, a new deflection starting from a position well above the reef horizon should be made. This hole, A.R. 5A, intersected the Reef at 7,570 ft., where it assayed 25·1 dwt. over a corrected width of 6·3 in. This deflected hole has itself been deflected twice, the Basal Reef being intersected in both cases with the following results: First deflection, at 7,572 ft., assaying 18·7 dwt. over 4·9 in.; second deflection, at 7,571 ft., assaying 55·3 dwt. over 3·3 in. In these deflections core recovery was complete, it is stated, and no further deflections are to be made.

A borehole result from PRESIDENT BRAND GOLD MINING was also published last month. Borehole S.P. 9, on the Farm Stuirmanspan, situated near the extreme Southern boundary of the mine, intersected the Basal Reef zone at between 5,450 ft. and 5,455 ft., assaying 1·0 dwt. of gold per ton over 63 in. The hole

was deflected twice and the Reef zone was intersected in both cases, showing 1·3 dwt. of gold over 54·5 in. and 0·93 dwt. over 58·5 in. At PRESIDENT STEYN, Borehole K.P. 12, on the Farm Klippan, situated 5,900 ft. south-east of No. 2 shaft was deflected twice, the Basal Reef being intersected with the following results : First deflection, at 6,543 ft., assaying 10·6 dwt. over 29 in., and the second deflection, at 6,543 ft., assaying 9·8 dwt. In the original intersection the Basal Reef was cut at 6,540 ft., assaying 13·8 dwt. over 23·9 in.

Diamonds.—As is noted by our South African correspondent elsewhere in this issue, the MARINE DIAMOND CORPORATION has announced that they are to make a large-scale attempt to mine diamonds from the sea-bed off the South West African coast. The concern has obtained a concession covering 176 miles of the coastline north of the mouth of the Orange River. The diamonds will be recovered by using an air-syphon and jet arrangement which has already been tested by removing shell, sand, and gravel from pipeline trenches underwater. The gravel on the sea-bed is forced up and transferred to diamond pans which have a combined capacity of more than 100 tons an hour, it is stated.

The results of the ANGOLA DIAMOND COMPANY for 1960 became available last month. The net profit amounted to Esc. 137,000,931, to which has to be added the balance brought forward from the previous year of Esc. 724,052 ; after deducting Esc. 34,600,000 for the interim dividend paid on January 16, 1961, there remains a balance of Esc. 103,124,983. In the year 1,051,979 carats of diamonds was produced, in addition to 4,847 carats recovered during prospecting. This work, mostly in the District of Lunda, resulted in nine new areas being selected for further development work. Special mention is made of one of the areas on the eastern bank of the River Chicapa, where a diamondiferous deposit was discovered estimated to contain about 90,000 carats in gravel yielding on an average 0·70 carats per cu. m. This discovery is considered of special interest as it opens up probabilities of the evidence of new deposits of diamondiferous gravel and new kimberlite formations in a section of the basin of the River Chicapa situated some few kilometres to the south of the rich zone already discovered.

Northern Rhodesia.—Preliminary figures put out by companies of the RHODESIAN SELECTION TRUST group last month show the progress of operations over the year to June 30 last. In that period MUFULIRA COPPER MINES produced 100,999 long tons of copper for an estimated profit of £6,527,000, while CHIBULUMA MINES produced 18,951 tons and made £1,047,000, before providing for taxation. ROAN ANTELOPE COPPER MINES reports an output of 81,451 tons and a profit of £4,559,000, again before providing for taxation.

Ghana.—At an extraordinary meeting of the ASHANTI GOLDFIELDS CORPORATION to be held on September 15 it is to be proposed that the capital of the company be increased to £3,000,000 by the creation of 2,500,000 new ordinary shares of 4s. each. The sum of £499,423 4s. standing at reserve is to be capitalized and shareholders will receive one new 4s. share for every three shares held.

Nigeria.—Towards the end of August a delegation from the NIGERIAN COAL CORPORATION was present at a demonstration of the coking of Nigerian coal at Simon-Carves, Ltd., Cheadle Heath, Stockport. Eastern Nigeria, it is reported, plans the erection of steelworks expected to cost between £30,000,000 and £40,000,000.

Tanganyika.—The accounts of KENTAN GOLD AREAS for the year to March 31 last show a profit of £129,659 and a total of £748,691 available, of which dividends equal to 3s. a share require £122,498. In the corresponding year GEITA GOLD MINING made a profit of £1,209. That company milled 260,080 tons of ore and recovered 44,210 oz. of gold. In the three months to June 30 last Geita milled 65,330 tons, which yielded 11,375 oz. of gold. A working profit of £3,295 was earned.

Northern Africa.—During the present year the BRITISH PETROLEUM COMPANY has completed extensive exploration work in three countries of North and West Africa. In the French Sahara, where the company is interested in permit areas covering a total area of 51,040 sq. k., the latest deep test well, El Allendaia, in the Oued Nsa permit, has reached a depth of 12,100 ft. A drilling programme of eight shallow wells is making good progress in the Oued Amenenad permit area. Two seismic parties, one a weight dropping " thumper " crew, are working in the central Saharan permits of Hassi Menkel, Djorf el Atfal, and El Hassine, while geological parties have been at work in the neighbourhood of Fort Polignac in the south-east and the Hassi Labbar permit area in the

south-west. In Senegal three medium depth test wells have been drilled this year. This completed the present phase of drilling and work is continuing on the review of the geophysical and well data gained. In Gambia the Sara Kunda deep test well located near Bathurst has been completed at a depth of 12,200 ft.

Australia.—It was announced last month by GOLD FIELDS MINING AND INDUSTRIAL, a wholly-owned subsidiary of the CONSOLIDATED GOLD FIELDS OF SOUTH AFRICA, that the CYPRUS MINES CORPORATION, of Los Angeles, had entered into a Joint Venture Agreement with CONSOLIDATED GOLD FIELDS (AUSTRALIA), PTY., to participate in the programme of mining exploration being carried out in Australia by the group. The Agreement is on a 50 : 50 basis and is initially for a minimum period of three years. The exploration programme is being undertaken by NEW CONSOLIDATED GOLD FIELDS (AUSTRALASIA) PTY., which has been carrying on exploration in Australia since 1956. The Gold Fields' companies will be responsible for the management and implementation of all exploration programmes and the Agreement will result in an expansion of the Group's exploration activities throughout the Commonwealth.

A further announcement in the current month was to the effect that CONSOLIDATED GOLD FIELDS (AUSTRALIA) PTY. had submitted to the directors of ASSOCIATED MINERALS CONSOLIDATED an offer to acquire 50% of the holdings of each shareholder for 21s. (Aust.) per share in cash. Consolidated Gold Fields (Australia) is also prepared to consider offers by shareholders who wish to sell more than 50% of their holdings for the same price. The offer is conditional upon Consolidated Gold Fields (Australia) acquiring a minimum of 50% of the issued capital of the company. Associated Minerals is a holding company registered in Sydney, New South Wales, and its subsidiaries work extensive deposits of rutile and zircon-bearing beach sands in Queensland and New South Wales.

With the recent dividend notice shareholders of MOUNT MORGAN were informed that the profit for the year to June 25 last was £372,321. The notice says that the low grade of ore treated persisted for the greater part of the year, but that considerable improvement has appeared in recent weeks and is expected to continue. The drop in grade is being compensated by achievement of higher throughput in the mills, while profits have benefited by reduction of the blister copper pipeline stocks.

The RIO TINTO MINING CO. OF AUSTRALIA reported last month that aggregate sales to June 30 showed an increase over the corresponding figures for the first six months of 1960. In July, 1961, a decision was taken to construct a modern brick plant at a cost of £2,000,000 at Campbellfield, Melbourne. Also in July, 1961, an option was taken to purchase the shares of certain companies in the Clinton Colliery Group which produces coking coal in the Burragorang Valley, near Camden, N.S.W. Rio Tinto, with its associate, FITZPATRICK INDUSTRIES PTY., has also announced that it is intended to start work shortly on the erection of a gravel crushing and washing plant on the properties recently acquired at Castlereagh, near Penrith, N.S.W.

Our correspondent in Kalgoorlie reports that the oil exploration drill at Eneabba on the Coastal Plains area north of Perth at 6,430 ft. entered coal of good quality and continued with the Coal Measure Series to 6,540 ft. Although recognized as a too-deep field the Government has immediately created a coal reserve. The Oil Titles are for *oil only* and are held by WAPET. The drill is giving technical information of great value. Previous boring on the Swan Coastal Plain (a well-recognized province in W.A.'s geology), has never penetrated beyond several well-marked aquifer zones. (The Eneabba bore also met water in its much shallower sections.) The coal has had some preliminary testing and is said to be " better than Collie coal "—which is a 10,000 B.Th.U. 20% moisture non-coking coal.

Shareholders of the MOUNT LYELL MINING AND RAILWAY COMPANY have been informed that operations for the year to June 30 resulted in a profit of £247,916.

New Zealand.—The operations of CLUTHA RIVER GOLD DREDGING in the year to March 31 last resulted in a profit of £13,051. With the sum brought in there was £16,238 available, of which £10,209 is required for dividends equal to 2d. a share. In the year dredging operations resulted in the production of 8,133 oz. of gold. In his statement accompanying the report and accounts the chairman says that the areas held by the company under dredging licence would normally take about five years to work out, but, with the present fixed price of gold and the ever rising costs of wages and materials, it is not likely, he thinks, that it will be profitable to work the greater part of Blocks 3 and 4.

New Guinea.—BULOLO GOLD DREDGING reports that in the three months to May 31 last 1,433,240 cu. yd. of ground was dredged or sluiced and 4,937 oz. of gold recovered. The report for the quarter states that the estimated net profit from operations in New Guinea and Australia for the year ended May 31, 1961, is $171,500, after providing $52,000 for income tax and $250,000 for depreciation.

Malaya.—At the annual meeting of CONSOLIDATED TIN SMELTERS held last month it was stated that the EASTERN SMELTING COMPANY, with the full concurrence of the parent company, is making immediate arrangements to transfer its residence and seat of control from the United Kingdom to the Federation of Malaya. Before the end of 1961, Consolidated Tin Smelters intend to offer for sale to the Malayan public 45% of the capital of Eastern Smelting.

India.—In a recent circular shareholders of the CENTRAL PROVINCES MANGANESE ORE COMPANY have been informed of the course of the discussions being held in India regarding the future of the company's leases. It is believed that an agreed solution is in sight, but that the formal approval of the Government of India to the basis has not yet been received, as other authorities not directly concerned in the negotiations have to be consulted.

Jamaica.—It is reported from Jamaica that MAGNET CONSOLIDATED MINES, of Toronto, is seeking permission to mine bauxite in Jamaica and that the application is now under consideration by the Ministry of Development.

Portugal.—The operationsof MASON AND BARRY in 1960 resulted in a profit of £47,843, the accounts showing £77,857 available, of which a dividend equal to 2s. 6d. a share requires £26,040. In the year 120,011 tons of pyrites was raised from the mine.

United Kingdom.—Reference to the accounts of GEEVOR TIN MINES for the year ended March 31 last was made in the last issue. In the year 66,151 tons of ore was milled and 657 tons of black tin recovered. In his address accompanying the report and accounts the chairman refers to the effort being made to recover access to the Levant workings, now flooded. An attempt is to be made to seal the breach in the sea bed and if the sealing is successful the water in the mine is to be lowered below the 40 fathom level and the position secured from inside the mine before proceeding to unwater the old mine workings. The company, " in conjunction with other friendly mining interests," has decided to spend capital in exploratory work. Cligga is one such area. " It was," the chairman said, " decided to explore in the first place by means of diamond drilling. A few holes have so far been drilled to comparatively shallow depths with encouraging results."

DIVIDENDS DECLARED

* Interim. † Final.

(Less Tax unless otherwise indicated.)

†**Anglo-Huronian.**—25 cents, payable Aug. 25.

†**Beralt Tin and Wolfram.**—2s.

***British South Africa Co.**—2s., payable Oct. 26.

†**Clutha River Gold Dredging.**—1½d., payable Sept. 29.

†**Contin Finance and Mining.**—7½%.

†**Falcon Mines.**—6d., payable Nov. 9.

***London and Rhodesian Mining and Land Co.**—3d., payable Oct. 20.

†**Mount Lyell Mining and Railway Co.**—2·1d., payable Oct. 21.

†**Mount Morgan.**—9d. Aust., payable Sept. 30.

†**New Witwatersrand Gold Exploration.**—3·6d., payable Oct. 28.

***Petaling Tin.**—4·2d., payable Sept. 16.

***Rio Tinto Mining Co. of Australia.**—3d., payable Sept. 29.

***St. Helena Gold Mines.**—30 cents, payable Nov. 8.

†**South African Torbanite.**—9d., payable Oct. 6.

†**Transvaal and Delagoa Bay Investment.**—11½%, payable Sept. 22.

†**Tronoh Mines.**—1s. 9d., payable Oct. 20.

***Winkelhaak Mines.**—6 cents, payable Nov. 8.

†**Witbank Colliery.**—14 cents, payable Sept. 21.

METAL PRICES

Sept. 9.

Aluminium, Antimony, and Nickel per long ton; Chromium per lb.; Platinum per standard oz.; Gold and Silver per fine oz.; Wolfram per unit.

	£	s.	d.
Aluminium (Home)	186	0	0
Antimony (Eng. 99%)	230	0	0
Chromium (98%–99%)		7	2½
Nickel (Home)	660	0	0
Platinum (Refined)	30	5	0
Silver		6	7¾
Gold	12	10	5
Wolfram (U.K.)		—	
(World)	6	7	6

Tin, Copper, Lead, Zinc } See Table, p. 176

Controlled Swivel for Wire Ropes

A. Seetharam, B.Sc., B.E., M.I.E.

Experiences with deep winds on the Kolar Gold Field are described.

Introduction

The present paper deals with torsion in stranded steel wire ropes when newly installed on a winder and the evolution of a controlled swivel from the experience gained with different methods adopted for the release of twist in such ropes.

Deep wind hoisting in vertical shafts using trucks in cages provided with chain suspensions is common on the Kolar Gold Field. Hoisting from 3,000 to 4,000 ft. depth is usual, while on Gifford's Shaft on the Champion Reef mine the depth of wind is 6,563 ft. Preformed right-hand Lang's lay wire ropes are used on most of these winders. Locked coil ropes are also used on some of the hoists and with these the same difficulties as with the stranded ropes when newly put on are not encountered. Where a stranded rope of considerable length is installed the torsion developed by the rope, when new, will be dangerous enough to twist the suspension chains if the suspensions are not rigid, as on a skip, and make working impossible until the excess torque is reduced to a safe limit.

Ordinarily, when a stranded rope is newly installed, a device called a friction swivel (Fig. 1) is used between the rope cap and the cage to release the twist developed in the rope. As the new rope is let down the shaft the twist is developed progressively and, on exceeding the frictional resistance of the working parts of the swivel, the top eye bolts rotate and release the twist in the rope gradually. After the cage is taken to the bottom of the shaft it is rested on keps or supports, thus releasing the weight of the cage when the swivel is freed and releases the built up torque. After the excess torque is thus released the swivel is taken out on return to surface and the rope commissioned for normal duties.

Although this method of releasing excess twist in a stranded rope when new is quite effective and gives good results for all ropes of about $1\frac{1}{4}$ in. diameter and below, it was found necessary to evolve a better method where control of release of twist is very essential due to excessive length of the ropes on Gifford's winder with $1\frac{7}{8}$ in. diameter preformed Langs lay wire rope. The main idea was to develop a method of controlling the swivelling to reduce the torque to a safe limit which will enable normal work with decking. On Gifford's preformed Langs lay ropes chain suspensions on the cages are used. Hoisting is by trucks in the cage and the latter is guided by mild-steel shoes working on steel rail runners fixed to steel byatts in the shaft. The cages rest on keps during loading and unloading of trucks. The shaft is dry and conveys dehumidified air.

Winder

The Gifford's shaft winder is a bicyclindro-conical 13 ft. to 35 ft. diameter double-drum winder, driven by two d.c. motors in parallel —rated at 1,250 h.p. each—through machine-cut double-helical single-reduction gearing. Each drum is loose on the drum shaft and provided with multiple toothed clutches operated by oil pressure. The drums and clutches are of cast steel, the former having spiral grooves for the rope. The winder was designed for an ultimate duty of 90 tons per hour but is now required to operate at about 50 tons to 60 tons per hour (maximum).—Particulars are given in Table 1.

Table 1

Depth of Wind . .	6,563 ft.
Shaft Angle . .	90°
Weight of Cage . .	8,100 lb.
,, ,, Four Trucks	8,100 lb.
,, ,, Ore . .	10,000 lb.
,, ,, 50 men .	5,500 lb.
Rope Diameter . .	$1\frac{7}{8}$ in.
Suspended Length of Rope . . .	6,630 ft.
Weight per ft. . .	about 6 lb.
Total suspended load .	61,384 lb.
Breaking Strength of Rope (Actual) . .	about 185 short tons
Factor of Safety of Rope	about 6 short tons
Hoisting Speed . .	3,000 ft. per min.

Rope Twist.

The great difficulty in kepping due to excessive twist in the ropes was initially

experienced when the first set of ropes were put on. The suspensions and chains were so dangerously twisted up that the Humble hook and attachment became almost horizontal. As it was found impossible to kep the cages at 70 level or at surface it was necessary to release the twist in the ropes sufficiently to allow for kepping without the chains twisting.

Although the makers designate the ropes as " Preformed " it is recognized that certain manufacturers do not carry the preformation process to the same stage as others who hold patents covering a more advanced technique which imparts to ropes of Langs lay, flattened strand construction, a more powerful anti-twisting characteristic than is possessed by other similar ropes of orthodox " Preformed " construction. This explains why some ropes behave differently to others. It was also surmised that the " handing " of the rope lay relative to the direction in which the ropes coil on the winding drum has something to do with increased twisting or otherwise. It is asserted by some authorities that, especially in the case of bicylindro-conical drums, if the right-hand drum carries the overlay rope, the ropes themselves must be left-hand lay; conversely, using right-hand lay ropes, the right-hand drum should carry the underlay rope. This practice is to ensure that the forces tending to make the rope rotate on its own axis shall, in the aggregate, have a tightening and not untwisting effect on the rope between the drum and the cage. The torsion in the rope is then in the direction in which it can best be resisted and the strands are prevented to the maximum extent from opening out. It was thought, however, that ropes of left-hand Langs lay would give better results. So far one odd left-hand Langs lay rope has been used at Kolar and no appreciable variance in performance found.

Swivelling Practice

Over a period of 20 years, up to 1960, seven pairs of ropes have been put on the Gifford winder and the controlled swivel has been developed with experience gained while installing these several sets of ropes. Details of construction of the seven sets of ropes are given in appendix A. A brief history of the relevant phases of the growth of the controlled swivel is necessary to have a clear picture of its development is given here.

First Set of Ropes.—

This set was the first to be put on in June, 1941, when the winder was installed. A friction swivel (Fig. 1) was used to reduce the

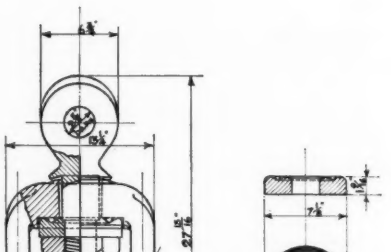


Fig. 1.—Friction Swivel.

excessive twist in the ropes to a limit which would allow kepping at surface and the bottom of the shaft. As usual, the friction swivel was fitted in place of the Humble hook, but the procedure in releasing the twist was different. In this case the cage was lowered 1,000 ft., brought up, and lowered on the keps on surface, resulting in release of torque from the rope. After release of sufficient torque the cage was lowered 2,000 ft. and the operation repeated on surface. This procedure was continued for each successive 1,000-ft. depths until the bottom was reached.

Rope Sets Nos. 2 and 5.—

The second set of ropes was installed in September, 1944, and the fifth set in November, 1951.

In the method adapted for releasing the twist in the first set of ropes, as the cage was brought up to surface every time for release of twist, the untwisting could release itself into the rope only between the cage and sheave or perhaps up to the winder drum. As this does not give a chance for the untwisting process to work itself uniformly through the operating length of rope a modified method, described later, was adapted on the subsequent ropes using the friction swivel.

The friction swivel in the case of these ropes was fixed in the place of the Humble hook and the cage then lowered to the 70 level. During the run through the shaft a certain amount of torque was released, evidenced by the periodical whip in the rope as it occured. It must be assumed, however, that most of the torque was released at the bottom of the

shaft. This was achieved by landing the cage on the keps, thereby diminishing the pressure between the friction plates in the swivel and setting up rotation. Once the swivel was set in motion, braking was immediately applied by lifting the cage clear of the keps. The swivelling under friction control continued until the twist in the chains was sufficiently reduced to permit landing on the keps. On the 2nd pair, however, the west rope did not untwist on its way down the shaft and when the cage was within 5 ft. of the 70 level, the swivel was given a tap which set it in motion, but after swivelling for about 10 seconds it broke and the cage with its attachments fell to the bottom of the shaft. The rope continued to untwist until it had lengthened by 20 ft. more than the east rope. The failure of this swivel was attributed to seizure between the working parts of the swivel and also to an incipient flaw in the legs.

As a consequence of this accident it was decided to use on the next pair of ropes to be put on a ball-bearing swivel (Fig. 2) which would be relatively frictionless and would not therefore resist to an appreciable extent the untwisting of a rope.

Rope Sets Nos. 3 and 4.—

The third set was installed on November 7, 1947, and fourth set on December 2, 1949. In the case of these two sets the ball-bearing swivel was used in a similar manner to the friction swivel, with the escape of torque permitted throughout the run of the cages in the shaft.

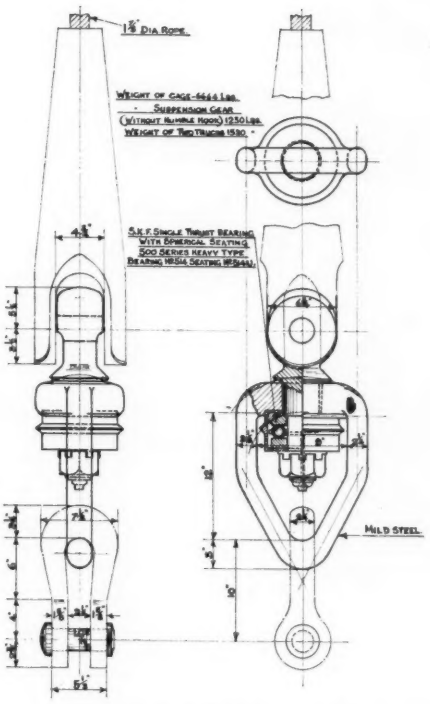


Fig. 2.—Ball-Bearing Swivel.

Performance of First Four Sets

The first pair of ropes appeared to be in excellent condition until September 16, 1944, when, as they were being reeled out to shift the dead coils on the small diameter of the drum, the tension was released, while the lay was gradually closing up along its length. The east rope at one place was about four turns down the scroll, actually bird-caged, exposing the hemp core. On examination the core was found to be bone dry and the inner wires in both ropes were intensely corroded. It was decided, therefore, to renew this pair.

Although the second pair of ropes showed no deterioration or defect after three years use they were changed owing to uncertainty of the condition of internal core and wires at the most stressed portions of its length, after the experience on the first pair of ropes. They were, however, found to be in good condition after discard. There was some initial damage to the ropes when in service, owing to pinching in the sheave grooves and slight corkscrewing and after this was detected it was remedied by regularly cutting the sheave wheel grooves to give correct clearance to the ropes. The groove diameter is usually cut to the nominal diameter of the rope *plus* 10%.

There was great difficulty while putting on the third pair of ropes which were oversize in diameter. This pair gave fairly satisfactory service until November 25, 1949, when excessive distortion over a length of 30 ft. from the start of the scroll on the east rope was detected. The lay pitch in this portion had increased to 39 in. and in spite of reducing the hoisting load by 50%, and even while preparations for renewing the ropes were being made, the pitch increased to 45½ in. in about 23 hours, when hoisting operations had to be stopped for immediate removal of ropes.

The fourth pair of ropes, which were in use from December 2, 1949, to November 14, 1951, gave cause for anxiety from the commencement of their working life owing to

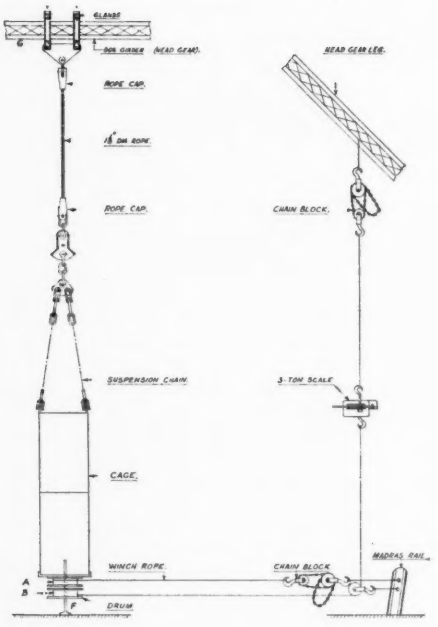


Fig. 3.

slackness of strands caused by over-swivelling with the ball-bearing swivel. Towards the end of their useful life both ropes showed signs of considerable wear and several broken wires (with fatigue fracture) were found within a short period. As the previous pair had also deteriorated rapidly after similar signs of fatigue fracture these ropes had to be changed.

The fifth set of ropes were swivelled in a similar manner to the second set. The swivel used was the ball-bearing swivel which was adapted as a friction swivel by removing the ball bearing and inserting mild-steel wearing rings in place. The lay pitch measurement for these ropes using the friction swivel was a maximum of 23·57 in., against 30·83 in. obtained on the previous ropes.

After the first trip down with the swivel on the east rope resting the cage on keps at 70 level, it was found that the swivel did not revolve and the chains were twisting excessively; when the cage was brought up to surface the swivel plate was found to have seized. This was remedied, a grease groove cut, and the swivel functioned all right thereafter with the use of graphite grease. This fifth pair of ropes gave very good service as seen from the tabulated details given in Appendix B.

Conclusions

A careful study of the behaviour of the first five pairs of ropes led to conclusions which may be summarized thus :—

(*a*) The ball-bearing swivel was the primary cause of the unsatisfactory behaviour of the third and fourth pairs of ropes, because it offered no resistance to the unlimited release of torque.

(*b*) Good results were obtained with a friction swivel in respect of the first and second pairs, not only because it offered sufficient resistance to prevent the escape of an excessive amount of twist, but also because it seized during the initial spins and thus reduced the amount of twist which would otherwise have escaped during the descent of the cage. It followed that still better results would be obtained by using a controlled swivel.

The release of twist from a rope should be limited to that which is just sufficient to prevent the cage chains from twisting, or the designed lay pitch at the capel end from shortening.

The torque which may have to be reduced by the release of twist is that which will be exerted by the rope when the cage is just clear of the keps at the 70 level.

Twist should not be released until that point has been reached for two reasons. First, because it will then be possible, by actual observation, to determine when the release of twist should be stopped by using the pressure gauge, and, secondly, because the exact increase in the length of rope caused by the release of twist can be determined.

It may thus be seen that if a controlled swivel is used the following advantages would result :—

(*a*) As no twist would be released from the ropes until the cages reached 70 level it seems clear that the release of twist would be from the total suspended length of rope and not any short length thereof.

(*b*) The release of twist would be effected gradually and at a uniform rate, thus eliminating the violent whipping of the ropes which occurred with a friction type of swivel.

(*c*) The total extension of each rope could be determined accurately and also the number of twists released from each.

During the rope-changing operations it is observed that the suspension chain twisting does not occur until the tension in the chains is reduced by kepping the cage and therefore

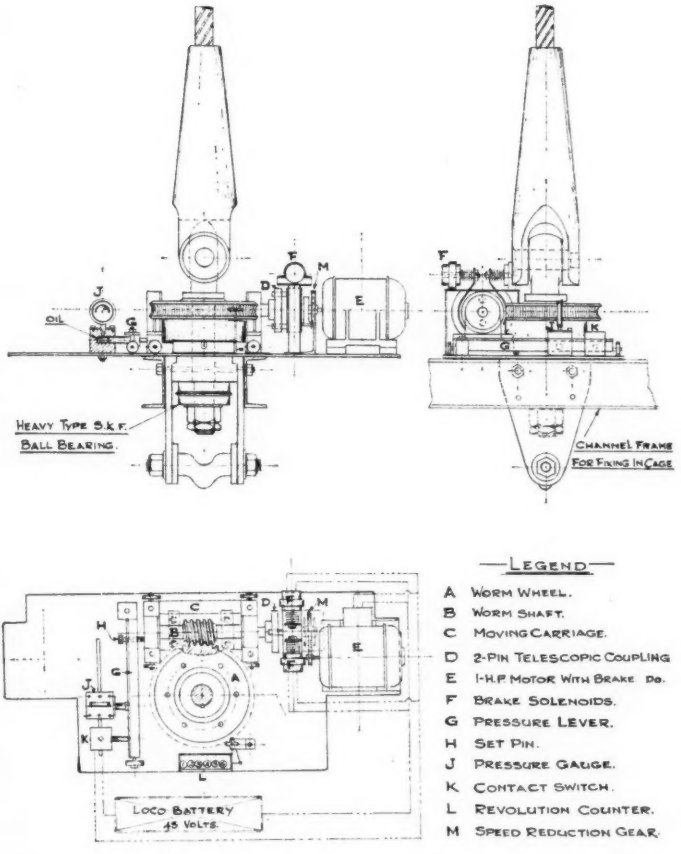


Fig. 4.—Controlled Swivel.

it was necessary to find the minimum torque at which the suspension chains would twist even when in tension. Therefore an experiment was conducted on a spare cage to find the value of this torque and is described hereafter. Fig. 3 shows the details of equipment and method of test. The spare Gifford's cage was suspended at G, from a point in Gifford's shaft house and by its own chains. The bottom of the cage gripped in a cage cradle which in turn was attached to drum A. Through the bottom of the cage and footed by means of a bearing in the ground is a pivot shaft F, maintaining the cage in a centralized position. This pivot shaft is clear of all attachments and left sufficiently long to permit guidance of the cage as it lifts due to chain twist. Drum B is loose on the pivot shaft and when required clutched into drum A. Drum A, which is attached directly to the revolving cage cradle, was rotated by means of a chain block, thereby causing twist in the suspension chains. The resistance in this case takes the form of a 3-ton weighing machine as shown in Fig. 3.

Taking a concrete example—assume that six twists have been induced in the suspension chain by means of rotating the cage through the pulley A, pulley B remaining unclutched. Now clutch in pulley B with pulley A, release the pull T exerted by the chain block, and the effort of the chains to untwist—T_2—will then be counterbalanced by the 3-ton scale S, on which T_2 may be registered.

The torque set by chain twist is calculated by the formula :—

$$T = \frac{D}{2}W = \text{lb.-ft.}$$

Where

T = torque.

$\frac{D}{2}$ = radius of pulley B.

W = load in lb. recorded on the Avery Scale.

The results of the test are as follows :

Rotation of Cage in turns.	*Torque Exerted by Twisted Chains PR = T lb.-ft.*	*Lift of Cage along its Vertical Axis. = in.*
0·50	658	3·75
1·00	979	4·00
1·50	1,184	4·50
2·00	1,726	6·00

Where

P = Equalizing pull necessary for preventing the suspension chains untwisting.

R = Radius in feet between axis of rotation and the point at which P is applied.

T = Torque in lb.-ft.

Cage rotation was stopped at two complete turns, as further twisting might have caused knotting of the chains with complications.

Controlled Swivel

Before any swivel design could be attempted the amount of torque inherent in a new unspun rope suspended with the cage attached at its maximum depth had to be determined. The test just described proves that this torque must be less than 658 lb.-ft.

The swivel, a diagrammatic presentation of which is given in Fig. 4, has been designed to achieve :—

1. Measure of torque in a rope from which it is suspended.

2. Automatic controlled torque release from the rope when it rises above a predetermined figure.

3. Hand-controlled torque release from the rope at any point below the safe limit of the machine.

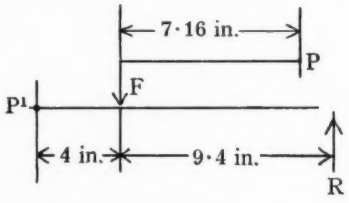
Description of Torque Machine.—

Fig. 4 shows a ball-bearing swivel carrying a worm wheel (A) attached to its revolving part. Any torque inherent in this part is transferred as pressure on the worm (B) which, being carried on a ball-bearing carriage (C) and free to move in a lateral direction, transmits the force to lever (G) through the set pin (H). Lever (G) in turn presses against a cylindrical plunger, 1 sq. in. in area, protruding from the block (J). This plunger moves in an oil-filled cylinder communicating with a gauge which measures the applied pressure. The measuring block (J) can be moved in a slot running parallel with the lever (G) for the purpose of calibration. An electric motor, fixed to the common base plate, drives the worm (B) through a two-pin telescopic coupling which enables the carriage (C) to have free lateral movement even with the motor in motion. The machine is equipped with a revolution counter (L) for the determination of the number of complete turns made by the swivel head.

Measurement of Torque.—

The automatic setting is such that for one lb.-ft. of torque exerted by the rope the pressure gauge will read 0·5 lb. per sq. in.

Moment diagram :—



(1) The distance of 7·16 in. from the pivot (P) represents the pitch circle radius of the worm wheel.

(2) F represents the force being applied by the worm shaft carriage to the pressure lever.

(3) P^1 is the second pivot about which the pressure bar moves.

(4) R is the reaction of the pressure gauge plunger to the force F—in other words, the pressure transmitted to the plunger.

In the above F = the force exerted on the pressure bar when one lb.-ft. torque is present in the worm wheel of the given radius 7·16 in. and is

$$\frac{12 \times 1}{7 \cdot 16} = 1 \cdot 676 \text{ lb.}$$

With force F about the pivot P^1 the reaction, or pressure, at R will be

$$\frac{1 \cdot 676 \times 4}{13 \cdot 4} = 0 \cdot 5 \text{ lb.}$$

The cylindrical plunger transmitting pressure to the gauge being 1 sq. in. in area, the 0·5 lb. pressure will be recorded on the gauge as such and will represent 1 lb.-ft. torque in the rope to which the swivel is attached.

Automatic Control.—

The electric motor (E), brake solenoids (F), contact switch (K), and the 45-V. battery are electrically inter-connected, the circuit being shown in dotted line. The switch (K)

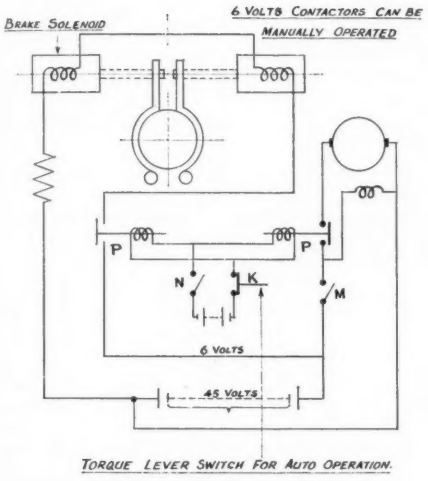


Fig. 5.—Circuit Diagram.

is closed by the movement of the lever (G) and is set to do so at a pre-determined torque recorded on the pressure gauge (J). When the switch (K) is closed the brake solenoids (F) and motor (E) are energized, resulting in the release of the coupling brake and starting of the motor.

With the release of torque the pressure against the switch rod is decreased, thereby causing the switch (K) to open circuit and the motor (E) to stop, with the simultaneous brake action applied to the coupling by means of the return springs at the head of the solenoids (F). This automatic action continues with the rise and fall of the torque, above and below the pre-determined value.

Hand Control.—

The actual electrical circuit controlling both automatic and hand operation of the swivel is given in the schematic diagram shown in Fig. 5. For hand control—that is, for releasing torque at a lower value than the pre-determined one for which the automatic devices are set—the following procedure will apply :—

Manually-Operated Switches.—Close open-circuit switches (M) and (N). Close 6-V. contactor switches (PP) which are ganged and arranged for simultaneous manual operation, thus energizing the brake solenoids, causing the bands to lift and the motor to start. By the opening and closing of this dual contactor switch (PP) the release of torque may be done at will.

Safe Working Limit of Controlled Swivel.—The machine has been tested up to 400 lb.-ft. before torque release, and up to 1,000 lb.-ft. indicated torque on the gauge, which is equivalent to 500 lb. per sq. in. on this dial. It is calculated that the safe upper limit for this machine, before torque release, should not exceed 600 lb.-ft.

Speed of Swivelling.—The speed ratio of worm and worm wheel is 60 : 1. The speed of the motor on a 45-V. supply is approximately 1,000 r.p.m. Therefore the swivel speed, with continuous torque exerted by the rope, will be about 16·7 r.p.m.

Tests on Controlled Swivel

After the controlled swivel was manufactured and calibrated a series of tests was conducted to get some more information necessary for proper use of the equipment. These tests fall into two groups—A and B.

Group A.—Tests conducted with the torque machine and cage suspended from a

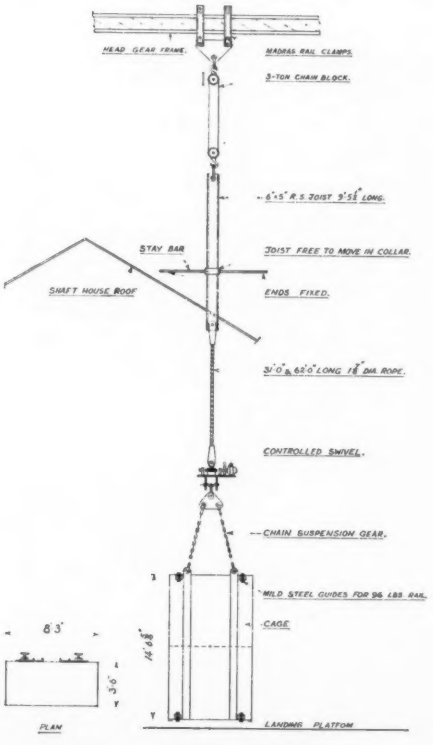


Fig. 6.—Test with Swivel Gear.

short length of $1\frac{7}{8}$-in. diameter winding rope in the shaft house, as shown in Fig. 6.

Group B.—Tests conducted in the shaft with the torque machine mounted in the cage and attached to the working rope.

Test A. 1.—To determine whether the torque in a length of rope was consistent with the measurement of lay pitch at the cappel.

The torque machine was mounted in the spare cage, and the swivel head attached to a 62-ft. length of Gifford's rope, suspended from a cross beam above the roof of the shaft house. The cage, thus held, was free to turn about an axis in line with that of the rope.

The cage was then rotated, by hand, until 400 lb.-ft. of torque registered on the gauge. A lay pitch measurement was then taken in a position approximately 5 ft. above the rope socket. The cage was then allowed to rotate in the reverse direction, recording lay pitch measurements at 360, 200, and 90 lb.-ft. torque.

Six tests were made the results of which have been set out in Table 2.

Table 2

Torque, lb.-ft.	*Pitch, in.*
400	12·83
360	13·02
200	14·57
90	15·52
400	12·97
360	13·42
200	14·82
90	15·27
400	12·92
360	13·16
200	14·18
90	15·23
400	12·98
360	13·20
200	14·90
90	15·48
400	12·87
360	13·27
200	14·62
90	15·44
400	12·87
360	13·60
200	14·60
90	15·40

Test A. 2.—To determine the relationship between length of rope, suspended weight at the end of the rope, and resultant torque.

Two lengths of $1\frac{7}{8}$-in. diameter Gifford's winding rope, one 31 ft. and the other 62 ft. long, were attached, one at a time, to a cross beam in the headgear above the shaft house, with the cage suspended on the lower end of the rope. The cage thus suspended was progressively loaded and the torque recorded as registered on the torque meter at each stage of loading, together with rope diameter, lay pitch, and stretch.

The results of these two tests have been set out in Table 3.

The tests described under Group B were taken for three reasons, one, to try out the torque machine under similar circumstances to that which it will be required during the swivelling operation; two, to find out the torque in the working ropes, and, three, to confirm the conclusions drawn from Test A.2.

Test B. 1.—To prove the torque machine, measure the amount of torque in the rope at increasing depths of 500 ft. and determine the effect of lengthening rope on the torque value.

The swivel gear was mounted in the east cage so that torque measurements could be recorded throughout the maximum wind in the shaft. The rope cappel was directly connected to the swivel inside the cage. On the downward trip the cage was stopped at intervals of approximately 550 ft. and a

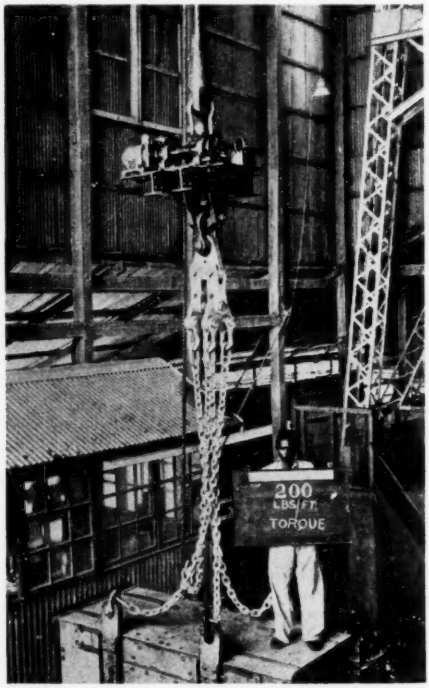


Fig. 7.

Table 3

Length of Rope under Test : 31 ft.

Diameter in.	*Lay pitch in.*	*Weight lb.*	*Stretch in.*	*Progressive, stretch in.*	*Torque. lb.-ft.*	*Torque. weight.*	*Remarks.*
1·95	14·97	—	—	—	—	—	Rope only.
1·92	15·02	6,664	—	—	150	0·02251	Cage put on.
1·92	14·94	11,039	$\frac{1}{8}$	$\frac{1}{8}$	195	0·01766	Weights added
1·91	15·04	15,414	$\frac{5}{16}$	$\frac{7}{16}$	280	0·01816	do.
1·91	15·05	19,958	$\frac{1}{8}$	$\frac{9}{16}$	340	0·01703	do.
1·90	15·06	22,902	$\frac{3}{16}$	$\frac{3}{4}$	395	0·01724	do.
			Length of Rope under Test : 62 ft.				
1·95	14·92	—	—	—	—	—	Rope only.
1·92	14·90	6,664	$\frac{1}{8}$	—	84	0·01265	Cage put on.
1·91	14·90	11,039	$\frac{3}{8}$	$\frac{1}{2}$	190	0·01721	Weights added.
1·91	14·94	15,414	$\frac{1}{4}$	$\frac{3}{4}$	250	0·01621	do.
1·90	15·10	19,958	$\frac{3}{8}$	$1\frac{1}{8}$	320	0·01603	do.
1·90	15·10	22,902	$\frac{3}{8}$	$1\frac{1}{2}$	395	0·01724	do.

torque reading taken with the cage at rest. The upward trip was made without stops.

The results of this test are set out in Table 4. At the beginning of the cage ascent the torque meter registered 150 lb.-ft., 10 lb.-ft. in excess of that recorded with the cage at rest.

Table 4

Downward Trip

Position of Cage, ft.	*Torque lb.-ft.*	*Rope Lay Pitch at Cappel, in.*
Cage on Keps	0	14·8
,, Lifted	90	
,, at 500	120	
,, ,, 1,100	130	
,, ,, 1,650	130	
,, ,, 2,200	130	
,, ,, 2,750	130	
,, ,, 3,300	130	
,, ,, 3,850	130	
,, ,, 4,400	130	
,, ,, 4,950	130	
,, ,, 5,500	140	
,, ,, 6,050	140	
,, ,, 6,563	140	14·9

Test B. 2.—This test, carried out on the west rope, was a repetition of the one performed on the east rope. As before, the swivel was mounted in the cage with the rope cappel connected directly to it. In this instance torque readings were taken during the trip down and up, stopping at 550 ft. for recording. The results of this second test are shown in Table 5.

Conclusions.—

Test A. 1. demonstrates that once the lay pitch-torque curve is plotted for a rope any future torque at the cappel end may be determined by the lay measurement of the rope just above the socket.

Test A. 2. indicates that rope torque is almost proportional to the load suspended on the end of it and is little affected by the length of the rope.

Tests B. 1. and B. 2 support the indications, obtained by Test A. 2 that the length of rope has little effect upon its torque. As will have already been noted, the torque advances only 10 lb.-ft. over a depth of 5,563 ft. Admittedly

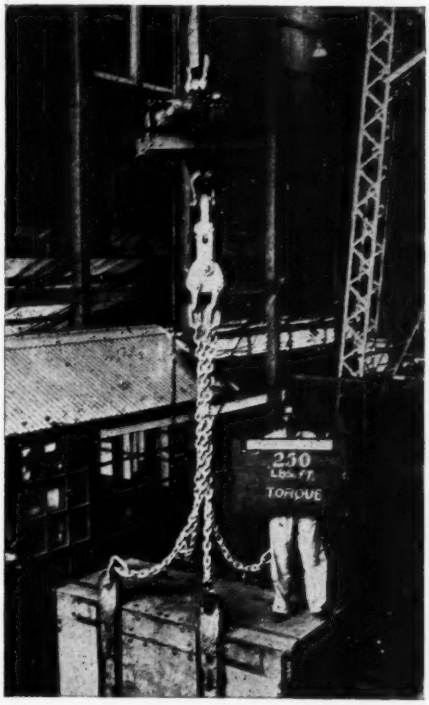


Fig. 8.

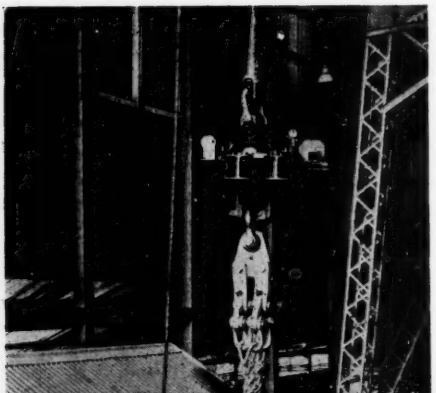


Fig. 9.

these readings were taken on ropes almost at the end of their working life. With new ropes other factors may come into play.

Test A. 3.—To determine the effect of varying rope torque on the behaviour of suspension chains, when the cage is landed on the keps and the tension in the chains is relaxed.

The test set up, as far as the cage was concerned, followed that used for tests A.1 and A. 2, the bottom of the cage being held in axial line with the rope by means of a pivot bar sufficiently long to permit the cage to rise and fall over its length.

Table 5

	Downward Trip		*Upward Trip*	
Position of Cage ft.	*Torque lb.-ft.*	*Rope pitch*	*Torque lb.-ft.*	*Rope pitch*
On Keps	Zero	15·47	30	15·00
Off Keps	90		120	
250	108		122	
800	120		126	
1,350	130		134	
1,900	130		136	
2,450	130		140	
3,000	132		142	
3,550	132		142	
4,100	134		144	
4,650	136		144	
5,200	140		144	
5,750	140		144	
6,300	144	14·97	144	14·97

The empty cage was suspended at the end of the 31 ft. length of $1\frac{7}{8}$-in. diameter Gifford's rope, by means of its ordinary chain suspension gear, with the controlled swivel between the apex plate shackle and the rope socket, as in Fig. 6. The rope suspension arrangement was such that the cage could be rotated to induce torque in the rope and then raised or lowered by means of a chain block to simulate the cage landing and leaving the keps.

The procedure for each of the readings given under "Results" was to rotate the cage until the desired amount of torque was registered by the "Torque Machine" and then land the cage and continue lowering the rope for a further distance, as would be the case under normal kepping conditions. The results of the several torque values have been given in Table 6 with the visual results shown by means of Figs. 7–10. For a 150 lb.-ft. of torque in the rope the chains merely sag with no definite tendency to twist. It was observed during the tests that with torque readings in excess of 300 lb.-ft. the chain links had a tendency to remain partially locked when the cage was lifted from the supports. This was evidenced after 400 lb.-ft. of torque was induced into the rope and the cage allowed to land; Fig. 10 shows the cage lifted from the supports and the locked chain links toward the top of the suspension.

Table 6

A	B	C	Fig.	Remarks
200	75	$\frac{1}{2}$	4	
250	75	$1\frac{1}{4}$	5	
300	90	2		Last turn about 3 ft. from bottom fastenings.
350	150	$2\frac{1}{4}$		Last turn about 2 ft. 6 in. from bottom fastenings.
400	150	3	6	Chains rigid from last turn to ends.

A = Torque at cappel before landing cage.
B = Torque remaining after chains had twisted.
C = Number of twists in chains.

Conclusion.—From this and previous tests it is concluded that the residual torque in the rope with an empty cage suspended should not exceed 250 lb.-ft., provided the upper reach of pitch is not exceeded.

Use of Controlled Swivel

The newly-developed controlled swivel manufactured in the mine workshop was first

used on the sixth pair of ropes put on Gifford's winder. The swivelling machine, supported in the cage and attached directly to the rope cappel was set to swivel automatically at 600 lb.-ft. torque indicated as 300 p.s.i. on the pressure gauge of the torque meter. The cage was lifted from the gate pieces and the initial recorded torque was 200 lb.-ft.

Observers then took their position in the capstan cage, which runs alongside one of the main cages and to record torque readings every 550 ft. down the shaft, prior arrangement having been made to stop the cage at these intervals.

As the automatic operation did not work satisfactorily hand operation of the swivel was resorted to. The rope was swivelled at different depths in the shaft, the torque not being allowed to exceed 500 lb.-ft. The hand-control switch controlling the swivel motor was operated by means of a cord.

With the high torque values worm gearing and the brake tended to over-heat. It was found that when the motor and worm gear were set in motion under the stress of considerable rope torque there was a tendency for the rope torque to take charge and to cause overspeeding of the machine and this had to be checked to prevent damage to the gearing. From the results of earlier experiments to determine the effect of varying rope torque on the behaviour of suspension chains it was concluded that the residual torque in a new rope should not exceed 250 lb.-ft. and therefore the rope was swivelled until the torque in the rope was reduced to this figure. During the swivelling of this sixth pair of ropes 1,104 turns on the west rope and 1,014 turns on the east rope were taken out. The increase in length of the full rope due to spinning is: West rope, 118 ft.; east rope, 107 ft.

After the experience gained on this pair of ropes it was considered that release of twist at the 70 level when the cage is at the bottom of the shaft would be most beneficial to the ropes.

Before the seventh pair of ropes were put on on August 17, 1958, necessary improvements were made for the swivelling machine since it was last used, in view of past experience. A new type of packing gland was provided for the pressure piston and a new pressure gauge with connexion for filling the cylinder without taking off the gauge was incorporated. A hand brake was also fixed to the main body under the worm wheel to

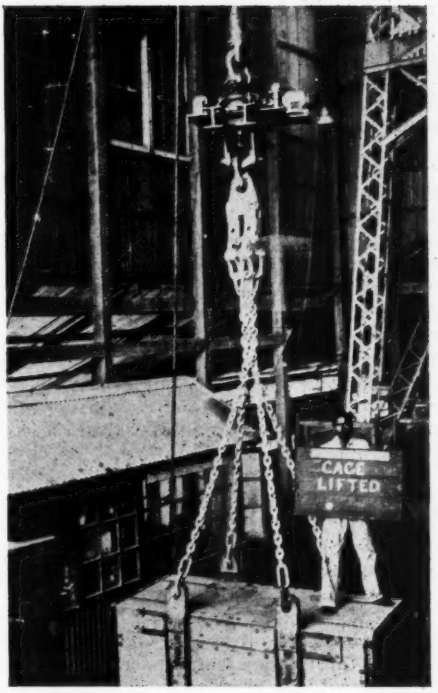


Fig. 10.

prevent the swivel overspeeding in case the worm wheel begins to drive the motor at high torque values. It was found during the swivelling operations on the previous ropes that signals were interpreted wrongly by the control on surface and the swivelling could not be successful in the shaft itself. The cage had to be brought up to surface every time and the rope swivelled. Therefore a simpler method of signalling was adopted by giving the signals from the road bell wires separately for the capstan and the winder straight to the respective drivers. No trouble was experienced thereafter on this account and the response to signals was satisfactory.

It has always been recognized that to achieve best results the ropes should be swivelled at 70 level and no spin should be released when travelling in the shaft or at surface. However, for some reason or the other, it has not been possible on any of the previous ropes to take the cage to 70 level without swivelling. It was feared that the cumulative torque would be very excessive with the risk of the worm-wheel gear teeth

breaking with serious consequences. As the arrangements made for observations in the shaft and the recording of the torque were successful it was possible to take the cage to 70 level without any release of spin in the shaft or on surface.

The swivelling machine was attached to the west rope, the writer travelling in the capstan cage, stopping and observing the reading on the swivel gear in the winder cage at every 550 ft., the winder cage being stopped by the driver for every five revolutions on the winder drum. The tabulated statement in Appendix D1 and D2 gives an account of the readings taken. At several of the intermediate stations a small extension in the rope is recorded, as at these stations the swivel was flicked by power for a fraction of a second to make sure that the gear is released and correct torque is registered on the gauge.

It may be observed from the tabulated statement that the maximum torque produced by either of the ropes when the cage is at 70 level is 540 lb.-ft., which is reasonably well within safe limits for the machine.

It has earlier been reported from experiments on the cage suspended by the chain slings that 250 lb.-ft. is the maximum residual torque that should be allowed in the rope for safe decking without a permanent entanglement of the chains and it was decided to reduce the cumulative torque to this value of 250 lb.-ft. (125 lb. per sq. in. on the pressure gauge) by swivelling at 70 level. When the cage reached 70 level the regular swivelling of the rope was undertaken and it took sometime to release a total of 834 turns to bring the residual torque to 125 lb./sq. in. on the gauge—*i.e.*, 250 lb.-ft.—at which swivelling was stopped. The cage was brought up to surface and taken down to 70 again with no appreciable change in the torque.

The swivelling gear was similarly attached to the east rope and the cage was taken to 40 level with the observers travelling in the capstan cage. At this level the swivel was given a start and it was observed that the pressure went up to 210 lb./sq. in. on the gauge. Then the cage was taken to 70 level with the observers reaching this level by the capstan cage. The maximum pressure recorded when the swivel was flicked at 70 level was 270 lb./sq. in. on the gauge—*i.e.*, 540 lb.-ft.—which is exactly the same as on the west rope. This rope was similarly swivelled to release 824 turns to get a residual torque of 125 lb./sq. in. on the gauge, equal to 250 lb.-ft.

During swivelling on both the ropes the lay pitch and diameter were being measured at surface to give a guidance for further operations.

For measuring the stretch on the rope while swivelling the cage was brought up about 4 ft. above the landing and swivelled from this position until the cage came level again. The procedure was repeated several times until the required residual torque was attained.

Although the worm gear is self locking, which is an advantage in controlling the start of the gear, it was found that above the 400 lb.-ft. of torque the worm wheel has a tendency to drive the worm and once during the operations on the first rope the gear actually overspeeded and it was found difficult to reduce the speed with the hand brake. This overspeeding can be overcome by suitably winding the driving motor, so that it will generate and feed back into the batteries thus acting as an electrical brake. This is to be incorporated on the present equipment.

During swivelling on the second rope an electrical fault developed in the motor (which was later found to be due to two connexions being damaged while working) and began smoking. Consequently the swivelling was considerably slower on this rope, as the motor had to be cooled with an air jet before starting every time.

Comparing the minimum lay pitch of the rope, after swivelling, measured at the collar of the shaft when the cage is at 70 level, it is interesting to note that the lay pitch of the present ropes is lower than before on any other rope, as the pitch varied from 22·88 to 30·83 when these ropes were still new and just put on. The number of turns taken out as recorded on the ropes on which other swivel gear have been used before have been 1,301 and 1,014, against only 823 to 834 on the present ropes. Even the extensions due to swivelling on these ropes are very much lower. There was a total stretch of 82 ft. 9 in. on the east rope and 80 ft. 2½ in. on the west rope, and 189 ft. 10 in. on the east rope and 104 ft. 4 in. on the west rope were measured and cut off before final recapping. The ropes were allowed a week to settle down, after which measurements of lay pitch and diameter were taken.

Kepping at 70 level was observed after five days and the ropes showed a slight tendency to twist the chains, which is taken care of by the anti-twist mechanism on the cages. Small improvements on the present

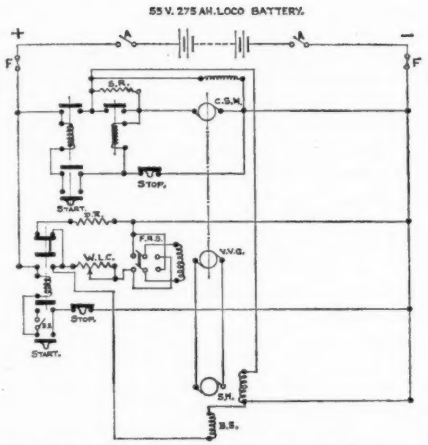


Fig. 11.—Ward Leonard Control Diagram.

controlled swivel are still being considered and it is hoped to have them incorporated very soon. The sixth pair of old ropes that came off the winder showed wavy formation when the suspended weight of cage, etc., was removed for reeling, but the formation of the rope was intact for the whole length of both of them.

Improvements to the Swivel Gear

After starting against the initial friction of the worm gear the motor rotation is, of course, in the same direction as the torque produced by the rope and thus the only way that energy can be absorbed is by the motor acting as a generator. As torques of about 7 lb.-ft. are expected on the worm shaft the electrical equipment must be capable of handling this. This was not fully realized and, as the only control of the motor was by direct "on and off" contact, this resulted in very high speeds on the motor with improper control and swivelling had to be done in short bursts.

To overcome these difficulties it was decided that: First, the swivelling motor should be coupled to the worm shaft *via* a 2–1 reduction gear, thus reducing the overall speed of

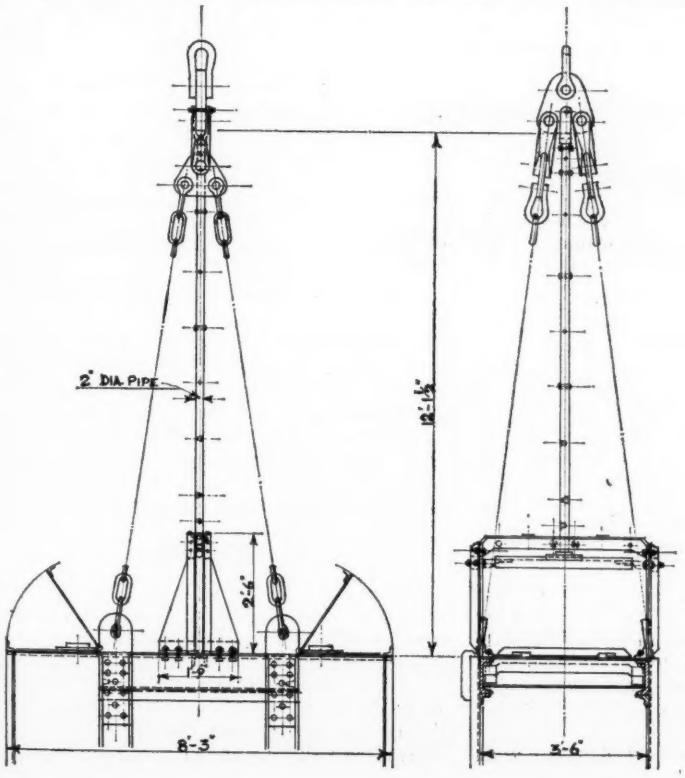


Fig. 12.—Twist Prevention Bar.

swivelling and bringing the torque rating of the motor within the range of torque developed on the worm shaft by the rope; secondly, that to provide a flexible control of the speed of the swivel motor, and an easy means of absorbing the energy of the rope, the Ward Leonard system of control be introduced. Fig. 4 also shows the drive reduction gear that has been designed and fixed.

The connexion diagram of this is given in Fig. 11. The 55-V. 275-amp.-hour nickel-iron type locomotive battery acts as a source of power for the motor generator set and also as a reservoir for absorbing the returned energy from the rope. The starting up of the M.G. set motor also energizes the field of the swivel motor direct from the battery. The operation of the swivel motor is now dependent on the operation of the contactor controlling the field of the variable-voltage generator. The push button of this contactor is arranged with a selector switch so that momentary or continuous running may be catered for. The final speed of the swivel motor is, of course, adjusted by the Ward Leonard controller in the generator field. Provision is also made for reversing this field and thus the direction of rotation of the swivel motor, if found desirable. A solenoid brake is provided on the worm shaft, the brake being released on the closing of the generator field contactor.

The whole of this equipment will be accommodated in the cage and all controls are to be mounted on a single panel and so situated as to be readily accessible from the capstan cage.

Fig. 12. shows details of a twist prevention bar for keeping the chain without twisting due to residual torque in the ropes. This mechanism is permanently fixed on the cage and is such that the chains can be lowered about 2 ft. if necessary without their twisting and will help in providing the slack in the chains necessary for kepping of the cages.

(To be concluded)

Ore-Handling Installation at Lysaght's Scunthorpe Works

New sinter plant and equipment designed to handle 600 tons per hour

Introduction

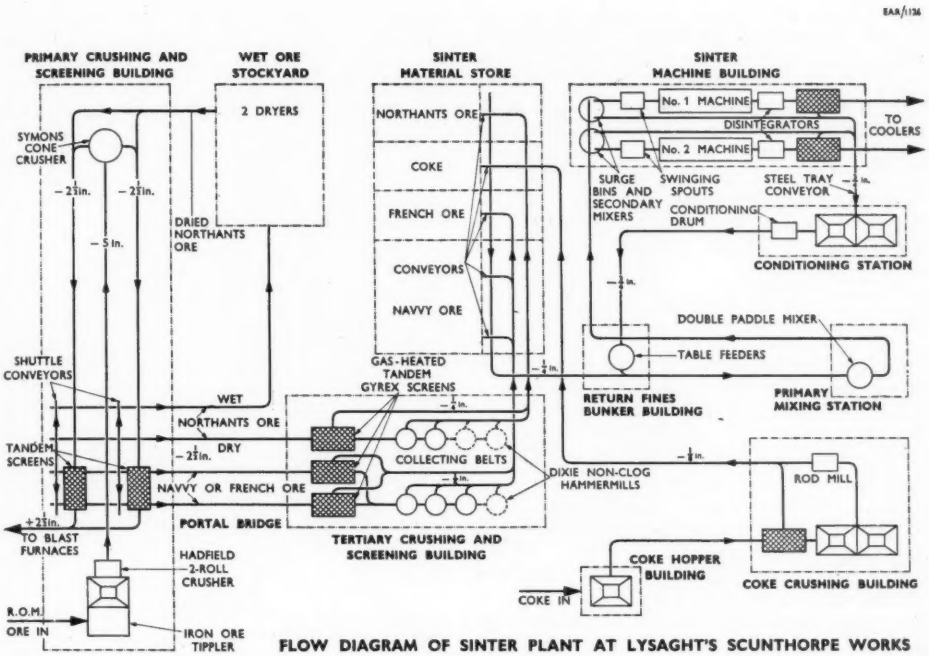
At the new sinter plant and ore-handling installation at Lysaght's works at Scunthorpe three types of ore are handled—namely, Lincolnshire (or Navvy, as it is called), Northamptonshire (Northants), and French. Of the three the Northants ore has proved to be the most difficult to handle because its moisture content is variable over a wide range, sometimes exceeding 20%.

The Lincolnshire or Navvy ore is won open-cast from an adjoining ore bed, in which it is estimated that there is something like 25,000,000 tons of ore available. Although this ore is of poor quality the ease of recovery makes it an economic proposition.

The foundations of the new plant are built on a worked-out portion of the Navvy ore bed, which has been subsequently back-filled to grade level with hard core. The main contractor for the project was Head Wrightson Iron and Steel Works Engineering, Ltd., who ordered ore-handling plant from the General Electric Co., Ltd., certain items being supplied through Ross Engineers, Ltd.

Primary Crushing

Ore is fed into the primary crushing and screening system through a wagon tippler, which is illustrated. Two stages of crushing are carried out, first to *minus* 5 in. in a Hadfield two-roll crusher and then to *minus* 2½ in. by two Symons cone-crushers before the ore is passed over the Gyrex primary screens. At this point the *plus* 2½-in. rubble



FLOW DIAGRAM OF SINTER PLANT AT LYSAGHT'S SCUNTHORPE WORKS

can be directed to the buffer bunker building for supplying the blast-furnaces. The *minus* 2½ in. from the two sets of primary screens are fed on to one of four belts by means of two shuttle conveyors, the belts being carried in a portal bridge to the fine screening and tertiary crusher building.

Under normal operating conditions two of the belts handle either Navvy or French ores, while the other two carry Northants ore, one being used for the wet ore and the other for the dry ore. The Northants ore has to be dried before it can be screened and tertiary crushed so that the Northants conveyor passes straight through the tertiary crusher building out to the wet-ore stockyard. Here two dryers are installed which reduce the moisture content of the ore to approximately 13% before it is re-introduced into the system just after the Symons cone-crushers in the primary crusher house.

Tertiary Crushing

The dried Northants ore is transported to the tertiary crusher building by the other Northants belt which feeds two gas-heated Gyrex screens in tandem arrangement fitted with a ¼-in. mesh, the throughs from these screens being carried direct to the sinter-material store, while 85% of the oversize is first reduced to *minus* ¼ in. by two "non-clog" hammer-mills before joining the throughs on their way to the sinter-material store.

Since the Navvy and French ores are not as sticky as the Northants ore no provision is made for drying them. Each of the two conveyors carrying these ores from the primary crusher building feeds Gyrex gas-heated screens in tandem. These screens, which are fitted with a ¼-in. mesh, are installed in the tertiary crusher building. An arrangement of collecting belts underneath the screens directs the throughs on to a single belt which carries the ore to the appropriate bunker in the sinter-material store. The oversize ore is first passed through one of three hammer-mills which reduces 85% of it to *minus* ¼ in. before it joins the throughs passing to the sinter-material store.

The five hammer-mills are supplied with ore by apron feeders located underneath surge bunkers which are kept filled by shuttle conveyors situated above them. One shuttle conveyor serves the three surge bunkers in

the Navvy or French line, while another supplies the ore to the two surge bunkers in the Northants line. Provision has been made for the installation at a later date of another mill in the Navvy line and two more in the Northants line. The mills used in the tertiary crusher building are G.E.C. Dixie 3650 non-clog machines. For the Navvy ore line the mills are fitted with moving breaker plates only, but for the Northants ore moving back plates are also fitted.

Sinter-Material Store

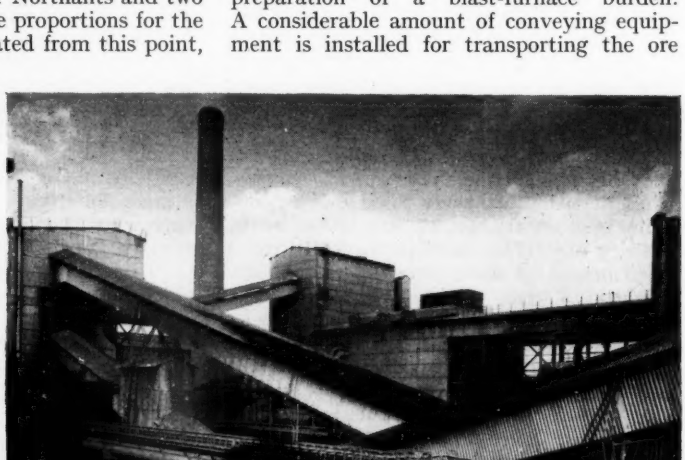
There are four separate bulk storage pits for the prepared ores and the coke in the sinter-material stores. Storage capacities of these pits are: Navvy ore 19,000 tons, French ore 7,000 tons, Northants ore 13,000 tons, and coke 2,000 tons. Ore is recovered from the store by the grab of a 12-ton overhead crane which tips the reclaimed material into circular bins supplying variable-speed rotating tables fitted with plough discharge facilities. Two of these table feeders can be used for discharging Navvy ore, two for the Northants ore, two for the French ore, two for coke, and two for flue dust. Provision has been made for the installation of a further four table feeders and bins, two for Northants and two for Navvy ore. Thus the proportions for the sinter mix can be regulated from this point, a typical mix consisting of: Navvy ore, 43%; Northants ore, 38%; French ore, 7%; coke breeze, 8%, and flue dust, 4%. No provision is made for adding limestone as the furnaces operate on a self-fluxing burden.

Coke Handling

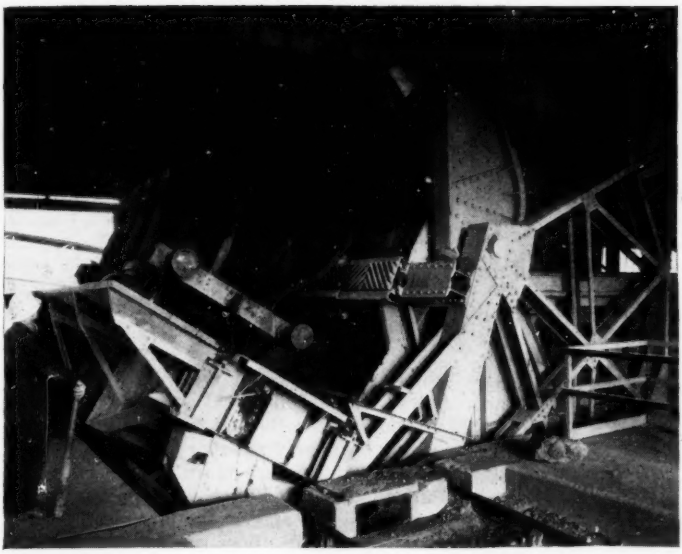
Coke is unloaded by a track hopper system into the coke hopper building, which has a capacity of 148 tons. It is extracted from beneath the hopper at a uniform rate of 80 tons per hour by a Sherwen electromagnetic vibrating feeder. This feeder directs the coke on to a conveyor system terminating in the coke-crushing building. Here the *minus* $\frac{1}{8}$-in. fraction is screened out and passed by conveyors direct to the sinter-material store. The *plus* $\frac{1}{8}$-in. coke fraction falls into bunkers, from which it is removed by Sherwen feeders and passed through rod-mills set to give a product size of *minus* $\frac{1}{8}$ in. The output of the rod-mills then joins the screened throughs going to the sinter-material store.

Sintering

Originally conceived as a process for agglomerating fine ores sintering is now recognized as an important prerefining step in the preparation of a blast-furnace burden. A considerable amount of conveying equipment is installed for transporting the ore



General View of the Plant.



Ore Wagon Tippler.

from the sinter-material store to, through, and out of the sinter-machine building.

A 500-ft.-long belt carries the raw material from the sinter-material circular bins to the primary mixing station where it is mixed in a large revolving-drum double paddle-shaft mixer. From here the raw mix is conveyed *via* an upper storey in the return-fines building to two surge bins and secondary mixers in the sinter-machine building, the distribution to the bins being regulated by a reversible belt.

Each surge bin feeds a 168-ft.-long sinter machine through a conveyor and a swinging spout which spreads the raw mix on to the machine strand. After passing through the machine the hot sinter is directed through a disintegrator and then over a hot-sinter screen which removes the *minus* $\frac{3}{4}$-in. fraction. All oversize is passed through a cooler before being taken by a 900-ft.-long conveyor system to the blast-furnace bunker building.

The dust collected by the belts underneath the sinter strands is joined by the throughs from the hot-sinter screens and fed by a steel tray conveyor into the hoppers of a conditioning station. From these hoppers the fines are passed through a conditioning drum on to a conveyor which takes them to the return fines bunker building. They are then discharged by table feeders on to the raw-mix conveyor ascending to the primary mixing station.

Research Programme for Lead and Zinc

In the coming year the United States Bureau of Mines has planned extensive research into problems affecting the mining and metallurgy of lead and zinc. It is announced that engineers in the Coeur d'Alene region of Idaho are to conduct laboratory and field tests on rock pressures and ground-support problems associated with deep mining, while the effectiveness of precast, segmented, reinforced-concrete drift sets, explosive shaping of rock bolts to obtain rapid rock-bolt anchorage, and the factors affecting the ground support of hydraulic stope fill will also be tested. Others will seek ways to reduce costs and to increase safety and efficiency of rock-drilling operations and breakage of rock.

An important part of the metallurgical research programme is concerned with recovery and operation techniques. These will include the use of a gas-fired vacuum distillation furnace and of the amalgam-electrolysis method to improve the separation and purification of metals. The use of micro-organisms in extracting lead and zinc from marginal ores, spectrophotometric evaluation of flotation reagents, radioactive tracers in leaching studies, reduction of sulphide minerals with atomic hydrogen, application of ultrasonics in electrodeposition of metals, and recovery from complex ores, slimes, and mill tailings are also to be studied.

Pinched Sluices

A. L. Stewart, A.C.S.M., A.M.I.M.M.

A study of a useful gravity concentrating device

Introduction

This paper describes a simple gravity concentrating device which, although fairly well known in the United States, is not so familiar on this side of the Atlantic. Essentially it consists of an inclined launder, 2 ft. or 3 ft. long; at the feed or upper end it is about 9 in. wide, narrowing to about 1 in. at the discharge end. Crushed ore or sand is fed to the sluice in a high-density pulp (50% to 65% solids) at as low a velocity as possible. The pulp flows down the sluice and the particles stratify as in any other flowing film concentrator, but the stratification is accentuated by the gradual reduction of width as the pulp descends, the stream on discharge being deeper than it is wide. When the pulp leaves the lower end of the sluice it is cut by splitters into heavy and light fractions. The general principle is shown in Fig. 1.

Design

There are two main types of pinched sluice on the market. These are the Cannon Circular Concentrator and the Carpco Fanning Concentrator. Both are manufactured in Florida and were originally designed to treat the local beach sands.

The Cannon Circular Concentrator, illustrated in Figs. 2, 3a, and 3b, consists of a unit of 48 pinched sluices arranged in a circle. The pulp is fed through inlet pipes on to a feeding segment to reduce velocity. It then flows into the upper ends of the concentrating segments or pinched sluices proper. The discharging streams at the lower ends of the sluices pass over a nose ring (which prevents the heavies creeping back under the sluice) and are then cut by a pair of concentric splitting rings into concentrate, middling, and tailing.

The Carpco Fanning Concentrator, illustrated in Figs. 4, 5a, and 5b, consists of a gradually-widening rising column, up which the pulp ascends until it overflows on to the upper end of the sluice. The sluices may be arranged doubly as illustrated or with only one sluice per rising column. At the discharge

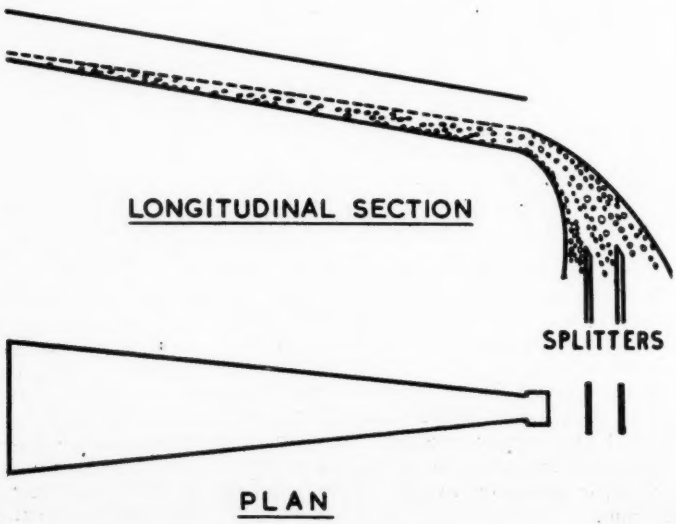


Fig. 1.

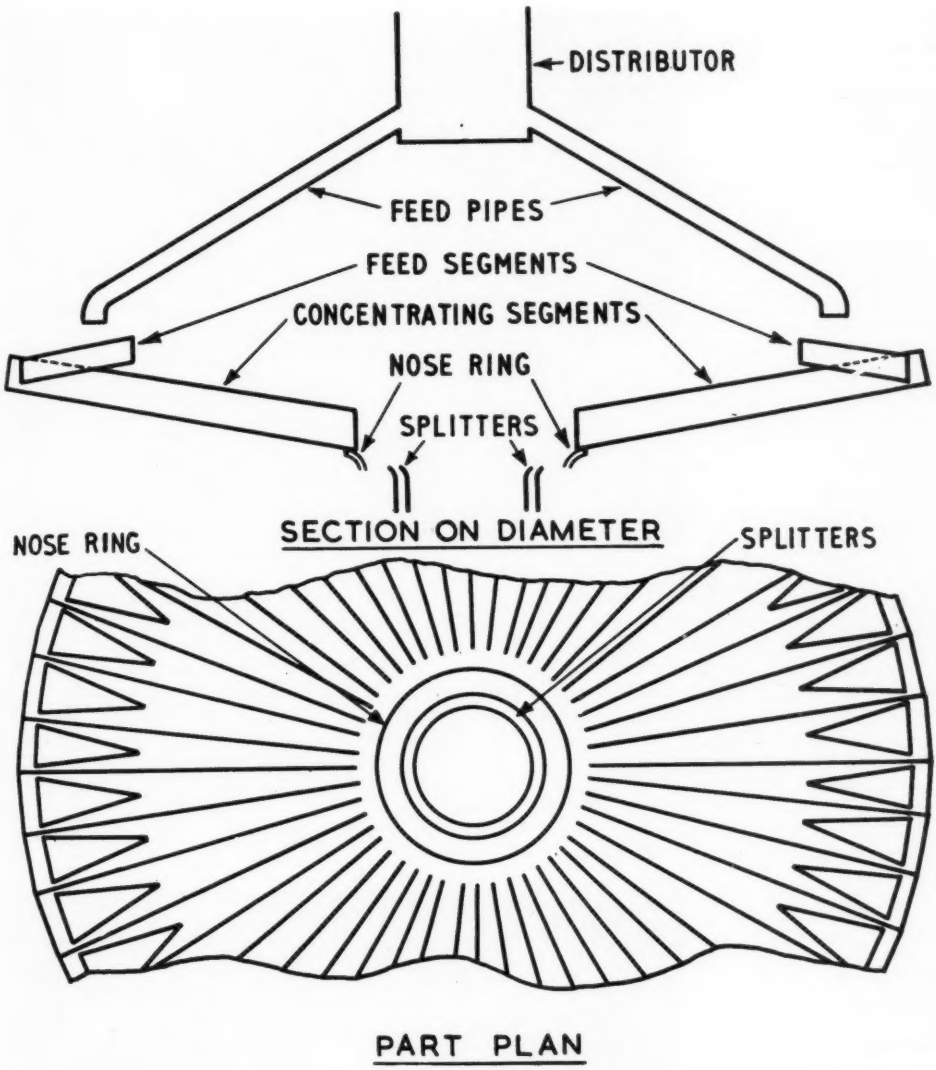


Fig. 2.

end of the sluice the pulp impinges on to a plate or fan set at a slight angle across the stream of the discharge. The fan has the effect of spreading the streams still further before they are cut by splitters at the edge of the fan.

There is yet another type of pinched sluice in use in Florida, but it is not yet available on the market. This type is illustrated in Fig. 6. Low initial velocity is achieved by a sump at the feed end of the sluice. The sluices are arranged in parallel opposed lines, each line having product cutters running the length of the line.

Operation

The pinched sluice was introduced for the treatment of beach sands, but it is applicable to almost all gravity concentration separations within the size range 10 mesh down to

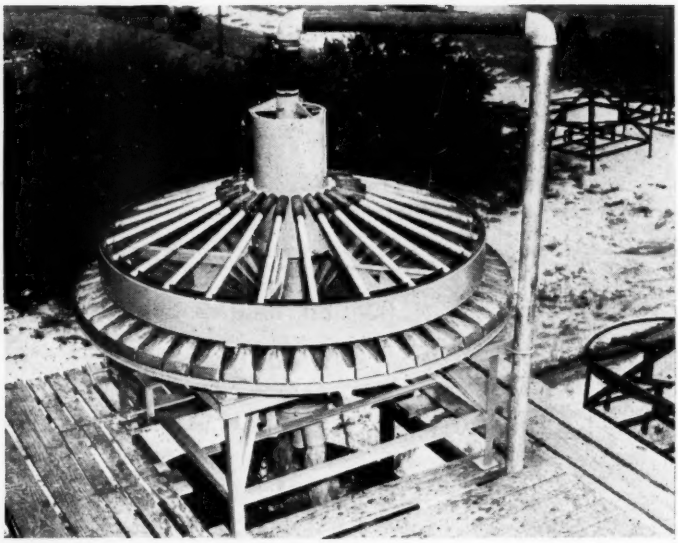


Fig. 3a.—Cannon Concentrator.

below 200 mesh and where the concentration criterion is greater than 1·7. An instance of satisfactory results being obtained outside the beach sand field is in the treatment of *minus* 150 mesh Labrador iron ore. In the case of the *minus* 35 mesh Wabush ore recoveries were as high as 88% to 91% with grades of 67·5% to 68·0% Fe, using circular concentrators.

Capacities of pinched sluices vary from half a ton of new feed per hour for fine feeds to 2 tons per hour of coarse material.

Fig. 7 shows a typical flow-sheet for the treatment of beach sands using circular concentrators. With a feed of 3% heavy minerals a recovery of 90% may be expected. When treating higher-grade feeds (over 15% heavies) it is usual to insert a scavenger

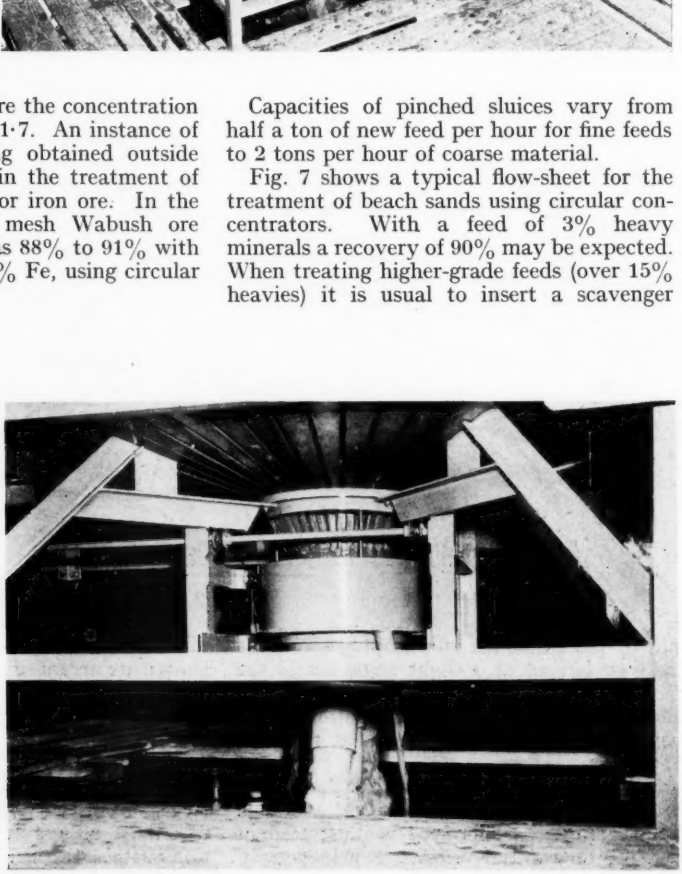


Fig. 3b.—Underside of Cannon Concentrator.

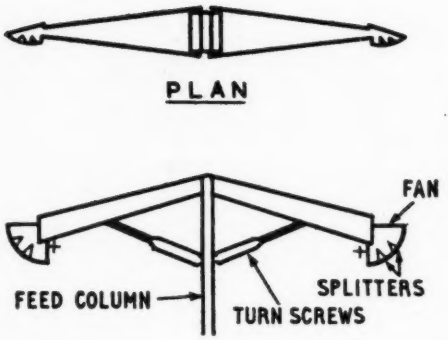


Fig. 4.

stage before discharging rougher tails. With circular concentrators it is sometimes preferable to do the final gravity cleaning on some other machine such as a shaking table, but this is not necessary with fanning concentrators as they are better adapted for cleaning.

The operating variables of pinched sluices are :—

(*a*) *Pulp Density*.—This is best controlled by the dilution water valve on the suctions of the feed pumps. It should be held at 50% to 65% solids, depending on the type of feed.

(*b*) *Splitter Position*.—This controls the proportion of material to be re-treated as middlings. On the fanning concentrator it must be changed on each sluice individually and on the circular concentrator it is effected by raising and lowering the splitter rings of each unit. In these machines it is important that the splitter rings remain concentric, otherwise the products from sluices on opposite sides of a unit will vary, with a consequent drop in metallurgical results. The long straight cutters of the third type of sluice mentioned above are probably the most easily controlled.

(*c*) *Slope*.—This should be such that the pulp is just able to gravitate without "banking"; it is usually from 16° to 20°, depending on the particle size and specific gravity of the material being treated. In the fanning concentrator the slope is adjustable by means of a turnbuckle fitted between the underside of the sluice and the rising column (see Fig. 2).

(*d*) *Fan Orientation* is only applicable to the fanning concentrator, where it has a considerable effect on the quality of the separation.

Flotation

An interesting development of the pinched sluice is in its use in a flotation rôle. There are two methods of achieving this, first, using the normal gravity concentration arrangement, but with the addition of reagents to the pulp, thus encouraging certain minerals to go into the light fraction. An example of this is the separation of coarse (*plus* 20 mesh) flake graphite from its gangue which, although difficult in a conventional flotation machine, is easily achieved in a

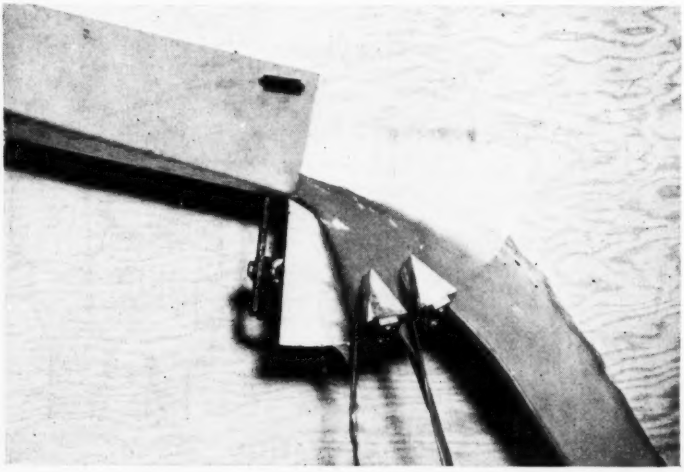


Fig. 5a.—Split in a Fanning Concentrator.

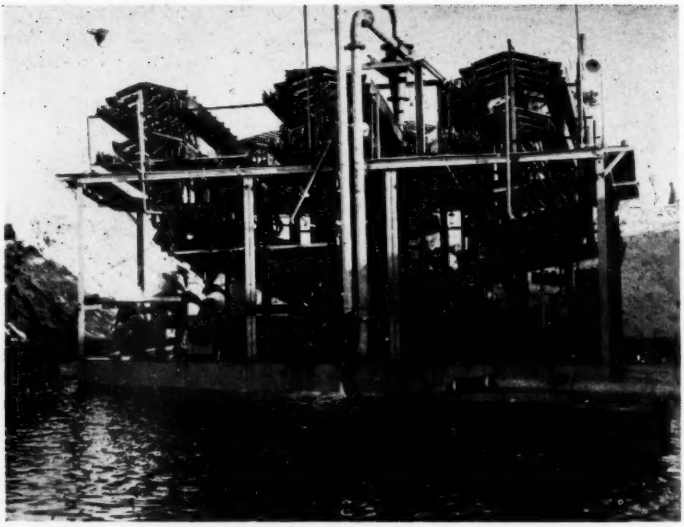


Fig. 5b.— Floating Plant in Australia.

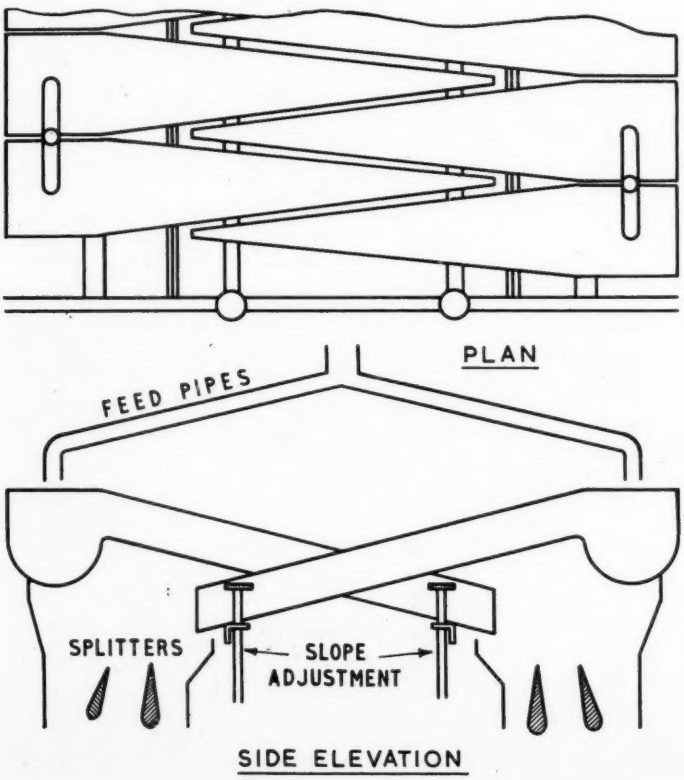


Fig. 6.

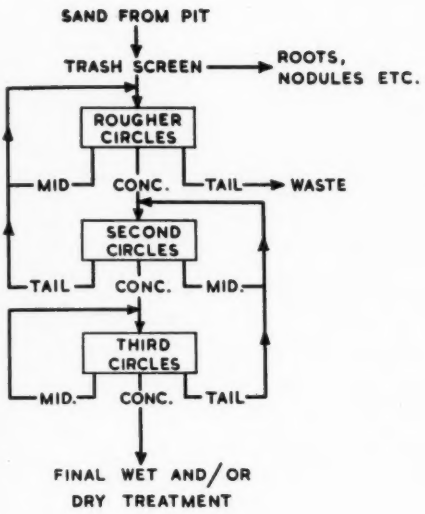


Fig. 7.

pinched sluice if a little collector is added to the pulp. Secondly, the circular concentrator has been especially adapted for the flotation of phosphate rock. Fig. 8 shows a section on a radius of such a unit. A pulp of density 15% to 20% solids and with suitable reagents added is fed to the unit in the usual manner, but on entering the upper part of the sluice the pulp passes over a fabric air ring through which diffuses low-pressure air, causing the hydrophobically-coated minerals to "float." As the pulp flows down the narrowing sluice it develops into three layers, a depressed layer, a water layer about $\frac{3}{4}$ in. thick, and a floated layer. The two mineral layers are separated by a single splitter ring set in the water layer as they leave the sluices.

It is probable that this application could be used in the separation of cassiterite and pyrite.

General Considerations

Pinched sluices are extremely simple and may be made of light sheet metal covered with neoprene or rubber on the surfaces which are most liable to wear. There are no moving parts except the pumps necessary to elevate the pulp. These two points lead to low capital and running costs as well as low weight and area requirements. One manufacturer quotes figures of 30 tons to 60 tons of new feed per hour per ton of equipment, or 0·38 tons to 0·76 tons per hour per sq. ft. It is thus possible to locate a large capacity on a small area such as a pontoon or a dredge, or to transport the plant from one point to another with ease.

These features make the pinched sluice a most suitable concentrator for the treatment of low grade or patchy deposits.

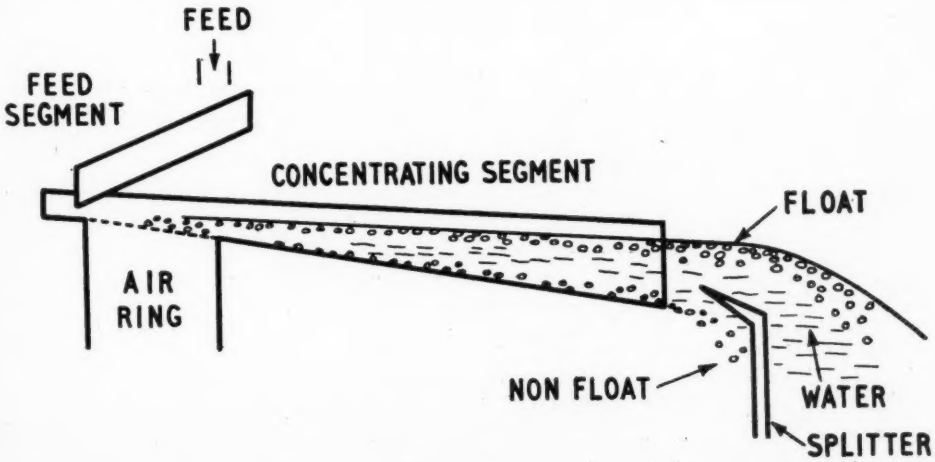


Fig. 8.

Ore-Dressing Notes

(7) *Leaching*

Acidic Corrosion

The increasing use of chemical methods of extraction, many of which call for the handling of acid slurries, raises a number of problems in milling. A paper by F. L. Laque in the *Canadian Mining and Metallurgical Bulletin* for May, 1961, on the deterioration of metals by acid slurries, is therefore timely. The destructive effect of such a pulp is influenced by the kind and concentration of the acid, the effects of substances dissolved by this acid, temperature, turbulence, abrasion by the solid particles, and shielding effects of adherent solids. The author discusses sulphuric acid in connexion with iron or steel, lead, Monel alloys, stainless steels, and titanium. For steel initial rates of attack are high, but protective films of modified ferrous sulphate soon form and slow this down, provided turbulence, abrasion, or high rate of flow does not prevent their development. In one laboratory test the mild abrasion caused by rubbing with glass of steel suspended in 98% acid accelerated corrosion a thousandfold, which would rule it out for most mill purposes even at much lower acid concentrations. Metals which are electropositive to iron and are taken into solution accelerate the corrosive attack.

Lead has a much better resistance than steel, particularly with the dilute sulphuric solutions commonly used in leaching. As with iron it depends for its resisting power on the formation of an insoluble film (lead sulphate and/or oxide). Although such films are stronger and harder to displace excessive turbulence or abrasion such as can occur in a moving pulp may remove them. The use of lead in these circumstances is therefore of limited value. If high temperatures and acid concentrations are used straight attack increases very rapidly.

A practical arrangement which deals with this propensity is that used in the leaching of a nickeliferous slurry in the temperature range 270° F. to 500° F., starting with 98% sulphuric acid at above 500 p.s.i. pressure. The steel shells of the autoclaves are clad with a lead sheath, protected in its turn by layers first of acid-proof and next of carbon brick, which both prevent abrasion and keep down the temperature of the lead.

With Monel alloys oxygen or an oxidizing agent is necessary for appreciable corrosion to occur in dilute acid solutions and attack falls sharply toward atmospheric boiling point where oxygen is no longer dissolved. Reducible metal ions are potent accelerators and 1% of ferric sulphate increases the rate forty-fold for weak acid at normal temperatures, while tin, uranium, and copper salts have similar effects. Monels are therefore unsuitable for the ordinary acid pulp. Most stainless steels depend for their resisting power on " passive " surface films, the composition and structure of which is controversial, owing to their extremely tenuous nature. Where iron is not a major constituent (as with the 40% nickel, 20% chromium, 3% molybdenum Ni-o-nel alloy) there is high inherent resistance to corrosion. Otherwise the oxidizing capacity of acid on stainless steel depends largely on the composition of the alloy. A high percentage of nickel improves resistance. Reducible metal ions have protective effects since they improve passivity and stainless steels of suitable structure are useful in handling slurries under specific conditions. In an uranium ore slurry at a pH of 2 and a temperature of 85° F. Monel was destroyed in 35 days, while an 18% Cr. 12% Ni. 3% Mo. alloy was hardly affected. Chlorides could aggravate corrosion of such an alloy by breaking down the passivity and stress corrosion cracking may also be set up. Titanium resembles stainless steel in its dependence on the surface protection of a passivated oxide film and is also adversely affected by appreciable concentrations of chlorides.

(8) *Production*

Bagdad's Cement Copper Plant

The new leaching plant at Bagdad, Arizona, started work in April and is producing about 200 tons of cement copper daily from low-grade oxidic stockpiles and oxide ore overburden. Construction began in August, 1960, and the sulphuric acid producer was ready for its 200 tons-per-day output by the end of March. There are two oxide ore stockpiles in adjacent canyons and the surface of the one now being treated has been divided into parallel 100 ft. square pools separated by embankments and delivering to a common overflow. They are shaped by bulldozing and the surface can be scraped by a bladed scraper when plugged. Acidic water, at the rate of 4,800 gal. per min., returns from the precipitation plant to the leach area

whence it gravitates to one of two settling ponds. The leach solution carries about 0·75% acid and there is an evaporation loss of some 30% per recirculation. Pregnant liquor, containing 1 g. per litre of copper, is delivered to 10 two-compartment precipitation cells in series and thence, after stripping, gravitates back to the stockpile, being reconstituted en route. Each cell is 13 ft. deep, above the steel grid on which rests the load of de-tinned cans, and 10 ft. by 9½ ft. in cross-section. The cement copper falls through the grids to the bottom of these concrete cells and thence is pumped to a sump which serves a Bird centrifuge. The cans are loaded from their concrete storage bin by magnets which register their load. Daily consumption of cans is 32 tons, an iron : copper ratio of 1·6 to 1. This loading is semi-automatic, with push-button control. Stainless steel and plastic equipment and shielding are used where needed to minimize corrosion.[1]

(9) *Comminution*

Steel v. Pebbles in the Ball-Mill (2)

In general discussion[2] D. B. Smith (Dennison Mines, Ltd.) considered that from their experience on hard and abrasive ores which used 2·67 lb. of steel balls per ton before going over to pebble milling there was a case for conversion when consumption exceeded 2 lb. per ton. Balls had cost $0.18 per ton milled, against which must be set such factors as a doubling of liner wear from its 3 cents per ton and the cost of producing and handling the pebbles.

R. J. Roach, speaking of experience with their acid-leach plant at Faraday Uranium Mines, could not make a direct comparison since the plant had milled on pebbles from the start. Reckoning ball wear at 1·1 lb. per ton and consumption of reagents by abraded iron it appeared that the saving was at least 20 cents. J. B. Mitchell, of Algom Nordic, gave figures before and after a recent conversion from balls to pebbles which showed a saving on reagents alone of 16.9 cents per ton milled, in addition to part of the cost of ball replacement (2·33 lb. per ton costing 16·3 cents) now obviated. Pebble making and handling at this plant costs 1 cent per ton and power cost in grinding has increased by 0·8 cents.

B. Robinson, of the Hardinge Co., drew attention to the influence of the treatment method on the grinding requirement, which differed in important respects between what was suitable for flotation and what was needed before cyanidation. Although, by custom, it was usual to evaluate grinding in terms of percentage *minus* 200 mesh, judgment ideally referred to the economic liberation for a given extraction of a specific value. This brought in the question of the right degree of force and its manner of deployment. He thought that autogeneous grinding was now increasing the element of muller-on-bucking-board action, in which the force used tends to be applied where it is needed rather than indiscriminately. With spheres as grinding media the point-to-point contact concentrated too much force, a defect avoided with the more irregular shape of the pebble. Additionally the pebble, having the same specific gravity as the ore, works selectively on the larger particles.

C. C. White, speaking of practice at Milliken, found that conversion to pebble grinding saved between 30 cents and 33 cents per ton, with improved metallurgy and reduced reagent consumption, after allowing for a trebling of liner wear. W. J. Dengler gave figures for the Bicroft semi-autogenous grinding operation, in which two parallel units are used, each using a rod-mill at 65% critical speed charged with 3-in. rods and fed with *minus* ½-in. ore, followed by a pebble mill in closed circuit running at 81% critical speed and charged with *minus* 3-in. *plus* 1 $\frac{5}{16}$-in. pebbles fed under automatic control. Pebble consumption is 3·1% of the total feed entry and a maximum demand wattmeter is invaluable in aiding the operator to maintain the correct pebble load. The low entry of abraded steel to the uranium leaching section saves 16 cents of reagent per ton. A. G. Roach, of Rio Tinto, made the point that when the pebbles are derived from the ore any change of grindability is accompanied by a change in the pebble hardness, giving automatic compensation. His experience covered soft and hard ores and showed considerable adaptability of pebble grinding to the various types.

The question of grate blockage by the pebbles was raised, and some speakers found that with tight control of pulp density and good design of grates no trouble arose. Answering F. C. Bond, who cited a rule-of-thumb ball-to-particle size ratio for steel balls (1-in. ball for a 1-mm. particle, 2-in. for

[1] *Engg. Min. J.*, June, 1961.
[2] *Canad. Min. Metall., Bull.*, Jan., 1961.

4-mm., 3-in. for 9-mm., . . . 5-in. for 1-in.) B. S. Crocker considered that the right size of pebble would be one of the same weight as the corresponding correct steel ball. One important point in the modern approach to pebble usage is that it is applied not to crushed ore at ½ in. down but to a maximum particle size of some 6 mm. The older generation of mill men used Danish pebbles, which were now known to be far too big for the work. With too large a pebble power cost mounted unnecessarily. A 10% rise in power cost amounted to less than 1 cent per ton and was therefore a small matter against the big saving reported widely by those who had switched to pebbles. Conversion costs could be written off in a year, in one speaker's experience, as a result of the saving.

This lengthy note leaves out a great deal of useful matter contributed to the forum and it is possible that its writer has taken unintentional liberties with the colloquial style of the discussion in the attempt to condense what is here selected.

Engineering Log

In the course of its exploration work in Great Britain the BP Exploration Company has recently been rewarded with several small but encouraging finds of oil. The latest discovery is at Glentworth, near Gainsborough, in Lincolnshire, where a test well found oil in the Coal Measures at 3,600 ft. At South Leverton in Nottinghamshire, where there was a find in the latter part of last year, further drilling is now in progress to find the extent of the oil accumulation, so that there are now four oilfields within eight miles of Gainsborough. The company has also had further successes, it is revealed, in some of its established fields. A new deposit has been found at Egmanton, while several new producing wells have been completed on the Corringham field, first located in 1958. Last year BP's English oilfields produced 85,281 tons and the output for the first half of the current year has totalled some 52,000 tons. The main producing fields are Egmanton, Eakring and Duke's Wood, and Bothamsall, in Nottinghamshire, with smaller quantities from Kelham Hills, Plungar in Leicestershire, and Gainsborough and Corringham in Lincolnshire. An extended production test of the well at Kimmeridge, Dorset, is also making a useful contribution to the total oil production.

The earth's mantle—the 2,000-miles layer between its crust and its supposedly liquid core—is being intensively studied following Gutenberg's work. Writing recently in *Nature* Dr. R. S. Dietz ascribes the surface patterns of mountain and valley to convection currents in the mantle. The rising currents become oceans, as the flow patterns spread thousands of miles and then gravitate down, the turning being marked by deep trenches on the ocean floor which move outward an inch or so annually. This may explain the rift valleys associated with tensions in the earth's upper layers, as well as the compressive force which throws up mountain ranges, It provides an interesting corollary to the older isostatic theories of drifting continents, like giant icebergs floating over plastic mantle. The Atlantic Ocean is held by this theory to result from convection (the mid-Atlantic Rise) which has moved the Americas away from the Eur-African mass. The thin crust of the sea floor is the upper part of the mantle, differing only from the main mantle by its lower pressure. The work, co-ordinated by an international committee at Helsinki, is still at an early and cautious stage of hypothesis.

* * *

The growth of production of glass fibre is expanding rapidly in most countries. As part of the present 7-year plan in the U.S.S.R. output is scheduled to increase up to 25-fold by 1965, as huge quantities are to be used for heat and acoustic insulation, housing, shipbuilding, chemical and other industries, and transport. In one automatic production line glass is melted in a conventional end-fired furnace which supplies feeders containing rhodium-platinum alloy bushings each having 15 orifices heated by low-voltage current. Glass threads emerge at 1,350° C. to 1,400° C. and are drawn out by jets of superheated steam, and sprayed with a binder based on a synthetic resin in solution. Each feeder produces a ton or so of fibre blanket daily. A paper on developments in east Germany describes production of reinforced plastic, roof sheeting, glass and textile-glass yarns, starting with 10-cm. lengths of glass rod melted through platinum troughs having 100, 200 or 250 orifices. Similar expansions are reported in Czechoslovakia.

* * *

A new nitric acid plant recently came " on stream " at the I.C.I.'s Ardeer plant. Its rated annual capacity is 55,000 tons at

100% HNO_3 and it replaces three older units. The acid is 60% strong and is mainly used in nitration processes connected with explosives. Liquefied ammonia is transported from Glasgow in 12-ton rail tankers and, after gasification and filtration, is mixed with air to give a mixture containing 11½% NH_3. Oxidation of the preheated mixture on rhodium-platinum alloy gauzes accords with the equation

$$4\ NH_3 + 5\ O_2 = 4\ NO + 6\ H_2O$$

and is performed slightly below atmospheric pressure, the gauze temperature being maintained close to 850° C. Conversion efficiency exceeds 96%. Oxidation of the nitric oxide and its subsequent absorption are performed in stainless-steel towers and the whole plant is largely automatic.

* * *

Although metal merchants have traded in Britain for hundreds of years, organized dealing, centred on the City of London, only dates back to the second half of the 19th Century, where it began in a corner of the Royal Exchange and later shifted to the Jerusalem Coffee Rooms. Later, after sharing space in the old Lombard Exchange, the present Metal Market and Exchange Co., Ltd., built the London Metal Exchange in 1881, where it has continued with two wartime interruptions. Recently it has undergone a major reconstruction, adding two floors to its original single-storey shape and in various ways brightening itself up. The "ring" has been retained, and business continues its traditional custom of calling bids and offers across it from the four curved benches where the ring members sit. The official opening of the new premises was made by the Lord Mayor on April 28 last, when at noon he spoke the traditional opening words of each market day—"Copper, gentlemen, copper".

* * *

Nitriding is a method of case-hardening steel by sorption of nitrogen and is used on parts subject to extreme wear to improve fatigue resistance. Among its advantages over carburizing treatment are freedom from distortion and applicability to intricate parts such as gears, while parts so treated retain their hardness at high temperatures. Real progress in the use began with the discovery by A. Fry, soon after the first world war, that the nitrogen used must be in the nascent and not the molecular form, which is only the case with ammonia gas at the moment of its dissociation into N and H. In this condition it can diffuse into the lattice of iron and distort it. The basic process calls for preliminary heat treatment of the iron or steel (or their alloys) followed by exposure for between 10 hours and 100 hours to ammonia gas at about 500° C. No further quenching or treatment is required, apart from any polishing, and distortion is negligible provided no part of the surface has been masked off. The plant required is a sealed container for the material, with inlet and outlet pipes for the gas, and an electric resistance furnace. Only slight gas pressure is used, but close temperature control is important. Nitriding steels in this country are Nitralloy (chromium-molybdenum-aluminium steel) and steels with no aluminium. In America temperatures of 525° C. to 535° C. are used, sometimes with a finish at 570° C. In designing a part for nitriding symmetry of the areas to be treated is important if distortion is to be avoided. A new development is the carbo-nitriding process, which is supplanting cyanide salt bath treatment.[1]

* * *

When comparing one fuel with another a convenient basis for comparison is its reactivity (ease of ignition, rate of pick-up from a cold start, etc.) compared with coal. It is related to the volatiles left after processing. Coalite contains some 10% to 12% of volatile matter, while high-temperature cokes have less than 2%. Comparing various solid fuels C. E. Needham[2] states that 60 years back the problem of smoke abatement led to Thomas Parker's low-temperature process, which yielded a smokeless fuel from a 500° C. heat, the patent being granted in 1906 although commercial production only followed after 20 years. Only two main methods are in full-scale operation today, the "coalite" and the "Rexco". Coalite uses the essentials of Parker's original process and currently produces about 750,000 tons annually, the carbonizing retort being a 2½-ton casting in the form of a nest of 12 tubes which ensure rapid transfer of heat through their walls. The retort is vertical, 9 ft. high, with tubes expanding down from 4½ in. diameter to 5¾ in., and each holds some ½-cwt. of coal. Gases emerge above to a common header and go to by-product recovery. The retorts are worked

[1] *English Electric J.*, Mar., 1961.
[2] *Inst. Pet. Rev.*, June, 1961.

in pairs with a common cooling chamber and 90% of the coalite is of large size, suited for open domestic fires. These tubes ensure rapid heat conductance and a fuel of ideal size with a minimum of breeze. Coal is charged in at *minus* 1 in. and is drawn from six collieries, which send in their weakly caking smalls unsuitable for gas works and coke ovens. The issuing gas is cooled to condense its heavier fraction, washed in oil to absorb the light hydrocarbons, and then used in the carbonizing retorts which are thus just self-supporting. Yield per ton is 14 cwt. to 15 cwt. of coalite, 16½ gal. of crude coal-oil, 3½ gal. of crude gas spirit, 34 gal. of aqueous liquor, and 4,000 cu. ft., of gas.

* * *

A " tunnel-driving pathfinder " made by a London firm shown recently has been developed for use where a tunnelling shield must be driven " blind ". A mirror mounted obliquely to the shield axis reflects the image of two correctly-aligned lighted targets in the finished tunnel on to a scale mounted on the shield. Any loss of direction results in a displacement of the signalled beam from its correct position. A six-mirror system used in driving London's Seven Sisters tunnel kept the deviation below 1 in. in 3,000 ft.

News Letters

BRITISH COLUMBIA

August 5.

Fort Steele.—The Crow's Nest Pass Coal Company earned a net operating profit of $362,801 in the first half of 1961, as compared with $343,363 in the same period of 1960. In the company's diversified operations production for the first half of 1961 was 378,982 (349,368) tons of coal, 65,023 (69,951) tons of coke, 130,553 (137,336) barrels of oil, and 5,508,516 (5,435,923) F.B.M. lumber. The company has purchased a further 10,000 shares of the common stock of the Calgary and Edmonton Corporation, to bring its holding to 30,000 shares. Crow's Nest also holds 60,000 shares of the Granby Mining Company.

Lillooet.—Production of Bralorne Pioneer Mines during the three-month period ended June 30 was 37,906 oz. of gold, valued at $1,326,710 ($35 per oz.), from 24,655 tons of ore assaying 0·65 oz. of gold per ton. Output was below normal owing to a modest reduction in tonnage milled and to the necessity for heavy withdrawals from low-grade stopes during the period of conversion to backfill-mining methods on the deeper and richer levels. The first phase of the mill-conversion project, consisting of the entire cyanide circuit, was completed on schedule and placed in operation on a tune-up basis. At the mine Dr. Franc. R. Joubin, the company's president, reports a satisfactory advance of several development headings, diamond-drill exploration being curtailed during much of the quarter in favour of development. Seasonal exploration on outside properties commenced in June when surface prospecting on the property covered by the Ace option was resumed. Trenching for the source of attractive antimony-gold float has exposed a vein 700 ft. long. Sections sampled to date have averaged 4·4% antimony with 2·2 oz. of silver and 0·04 oz. of gold per ton over an average width of 3·5 ft. and length of 125 ft.

Similkameen.—The Granby Mining Company earned a net profit of $53,051 for the first half of 1961. This includes a non-recurring item of $90,244 profit resulting from the sale of shares in Granduc Mines, Ltd. The Phoenix Copper Company treated a substantially greater tonnage and this, together with the higher price for copper, is reflected in the improved earnings for the quarter. Consideration is being given to increasing the capacity of the Phoenix mill from 1,000 tons to 1,500 tons daily.

Clearing the plant site of Jedway Iron Ore, near the southern tip of the Queen Charlotte Islands, is well under way and building construction has commenced. To provide the $4,500,000 required for this project Jedway is borrowing $2,000,000 from the Granby company's bankers on a " last in, first out " basis, $1,500,000 from a New York investment-banking group, and $1,000,000 from Granby. The investment-banking group will hold 25% and Granby 75% of the common stock of Jedway Iron Ore.

Slocan.—Silver Standard Mines has entered into an agreement for the exploration and development of a group of 59 crown-granted claims and fractions one mile south-west of Sandon. The claims were previously owned by Kelowna Exploration and developed by that company at a cost of $500,000 prior to voluntary liquidation, at which time they were transferred to Oil Participations, Inc., an American firm with which Silver Standard has contracted. The property extends 9,200 ft. along the Standard–Silversmith lode and includes within its boundaries such well-known former producers as the Carnation, Wakefield, Mascot, and Minehaha. It is on the same structure and very

close to such famous high-grade silver-lead producers as the Standard, Mammoth, Silversmith, Ruth Hope, and Slocan Star and is only 1½ miles due south of the ViolaMac mine. Mr. H. B. Gilleland, Silver Standard's manager of mines, says the area has been geologically surveyed probably more intensively than any other part of British Columbia. All reports agree in their interpretations and the maps, reports, and notes are available to Silver Standard's engineering staff, which has been working on the problem for the past two months. Any underground work to date has been on the 5,500-ft. level or higher. Kelowna Exploration found a number of small high-grade lenses but these were considered short of economic value. Deeper development was urged, but the parent company would not make funds available. Silver Standard Mines will make a test of the 400-ft. vertical interval to the 5,100-ft. elevation and diamond drilling is to commence at once. If this offers sufficient incentive underground entries will be provided.

Cariboo.—Early in August the directors of Wingdam and Lightning Creek Mining were greatly encouraged by a report from Mr. C. W. S. Tremaine, the chief consulting geologist, that grouting operations have been successful in sealing off what is believed to have been the source of the inflow of water-bearing sediments responsible for the shutdown of operations of the Wingdam deep-lead placer mine by Consolidated Gold Alluvials of B.C. in 1936. The work involved the drilling of a 192-ft. bore-hole from surface to permit injection under pressure of grouting material into what is known as the "rise into No. 1 downstream drive." Further unwatering of the Melvin shaft has been halted at a depth of 159 ft. to provide maximum protection to the grouting operation. Construction of new mine buildings and houses for staff accommodation for year-round operation is nearing completion.

Skeena.—Silbak Premier Mines is preparing for the construction of a second concentrator to restore the 600-ton plant destroyed by fire six years ago. Size and type of the new mill will be determined on the result of the present ambitious exploratory programme. The engineering staff is making a detailed study as to the most efficient means of ascertaining the depth persistence of the high-grade vein standing almost vertically in the foot-wall of the glory hole. At the same time a re-assessment is being made of milling-grade ore, most of which is contained in the former Premier Border mine, purchased by Silbak Premier in 1959. Four shipments of high-grade ore have been made so far this season from the high-grade glory hole vein after entry was made through an extension of the No. 1 level. Net smelter returns of $43,521 have accrued from these shipments. On July 29 a fifth shipment of 15 tons of spectacularly high-grade ore was made. Assays prior to dispatch indicate a grade of 33·6 oz. of gold and 303·0 oz. of silver per ton. Salvage of concentrate is continuing at the old mill-site. Current recovery is at the rate of 15 oz. of gold to the ton.

Clayoquot.—New Privateer Mine has driven ten short drill-holes for a total length of 1,618 ft. to explore the "A" and "B" copper-containing shoots in the Uebell group, adjoining the Privateer No. 3 claim. The intersections obtained, together with surface assessment, reveal an indicated length of 270 ft., with an average width of 18·8 ft. and grade of 2·19% copper in the "A" zone and 170 ft. with average width of 25·02 ft. and grade of 2·06% copper in the "B" zone. Both zones are open along strike and at depth. A reserve of 100,000 tons of ore averaging 2·08% copper over an average mining width of 22·6 ft. is estimated. Both zones appear to stand almost vertically. The shaft in the Privateer mine has been unwatered in preparation for diamond drilling from the floor of the bottom level to confirm the persistence of the Nos. 3, 4, and 5 veins below that horizon. Some 10,000,000 gallons of water were pumped out of the mine in a two-week operation.

Yukon.—Kootenay Base Metals has acquired and done considerable work on a potentially high-grade silver property near Teslin Lake, within 14 miles of the Alaska Highway. Veins have been exposed on a steep ridge over a vertical interval of 450 ft. Average grade over a length of 1,000 ft. is 0·13 oz. of gold and 30·0 oz. of silver per ton with 3·5% lead and 3·0% zinc with an average width of 2·5 ft. A diamond-drill hole cut 2·0 ft. assaying 50·0 oz. silver per ton at a depth of 1,000 ft. vertically below the highest outcrop.

EASTERN CANADA

August 25.

Ontario Gold Output.—During June the gold mines of Ontario treated 762,113 tons of ore and recovered 210,470 oz. of gold and 33,080 oz. of silver, together valued at $7,626,339. The Department of Mines "Gold Bulletin" for June states that for the first six months of 1961 the Province's 30 producing gold mines reported milling 4,684,580 tons of ore, from which they obtained 1,346,230 oz. of gold and 196,348 oz. of silver, valued at $47,052,836. For the same period in 1960, 30 mines reported milling

4,699,047 tons of ore, from which they obtained 1,346,573 oz. of gold and 224,758 oz. of silver, valued at $45,590,865.

International Nickel Co.—The interim report of the International Nickel Co. of Canada, Ltd., and subsidiaries for the six months ended June 30, 1961, shows net earnings in terms of U.S. currency of $37,653,000 after all charges, depreciation, depletion, taxes, etc., equivalent to $1·28 per common share. In the first six months of 1960 net earnings were $43,902,000, or $1·50 per common share. It is stated that deliveries of nickel in all forms during the six months were slightly below the total deliveries in the first six months of 1960 and about 10% above the deliveries for the second six months of 1960. It is thought that with the United States steel industry looking forward to increased activity, nickel demand will strengthen further in the last six months of this year.

Porcupine.—Kam-kotia Porcupine Mines started production in April, the ore feed coming from open-pit operation. Ore reserves, based on diamond-drilling intersections, are estimated at 1,301,000 tons averaging 1·825% copper, located within the boundaries of the open-pit to a total depth of 180 ft. Of this tonnage 180,700 tons contains an average of 2·675% zinc. In addition, 260,000 tons grading 3·12% zinc have been outlined within the pit area but outside of the copper-bearing zone, while another 882,000 tons grading 3·672% zinc have been indicated outside the pit area and below the proposed bottom of the pit.

Manitouwadge.—In the six months to June 30 last Geco Mines milled 608,471 tons of ore averaging 1·40% copper, 3·18% zinc, and 1·37 oz. silver, the estimated operating profit after provision for taxes being $2,286,000. The work of rehabilitation of the " B " zones stopes, it is stated, is up to schedule and drawing mill feed from this area should resume sometime during the third quarter. Since the end of April the drive on the 2450 level has been extended a further 700 ft. east. The results indicate on this level a total length of 1,200 ft. averaging 1·60% copper and 4·52% zinc across an average width of 117 ft. The ore-body is still open to the east.

Manitoba.—The first consignment of nickel from Thompson, Manitoba, shipped at the Hudson Bay port of Churchill at the beginning of the very brief open season, arrived at Swansea on August 12, en route for the Clydach works of the International Nickel Company (Mond), Ltd. There the 2,700 tons of full-sized cathodes are to be cut to 4-in. squares and packed for distribution to European steel mills and other consumers. The International Nickel Company of Canada's $185,000,000 Thompson project is expected to increase the world's annual nickel supply by some 37,500 tons, half of which is destined for consumption in Europe to meet the steadily-increasing demand.

It is reported that Hudson Bay Exploration and Development has taken an option on the base-metal prospect of Lake Kississing Mines. This lies west of the old Sherritt Gordon Mine.

Quebec.—The mineral production value of Quebec Province for 1960 will total an estimated $441,375,965. This represents a slight increase over the previous year when mineral production value stood at $441,299,661.

The operations of East Malartic Mines in 1960 resulted in a profit of $437,411. In the year 544,939 tons of ore was treated, the gold output being valued at $3,765,735. At the end of 1960 the ore reserves were estimated to be 1,821,586 tons grading $6·39 per ton. It is reported that work on the internal No. 5 shaft is ahead of schedule and that new discoveries at the 19 m. and 24 m. levels was considered encouraging.

In a report for the six months to June 30 last shareholders of the Quemont Mining Corporation have been informed that 430,519 tons of ore had been treated for an estimated profit of $1,110,000. In the same period the Normetal Mining Corporation milled 180,300 tons and made a profit of $643,700.

AUSTRALIA

August 21.

Tin.—The rising Australian internal demand for tin and the improving price for the metal has led to hopes that prospecting for tin might be stimulated and production from new discoveries or abandoned mines increased. There has been some exploration in the Northern Territory, but the most recent positive move has been made by Aberfoyle Tin N.L., an important producer of tin and wolfram in Tasmania. As the ore-bodies are approaching exhaustion the company recently acquired the Storey's Creek wolfram mine, which is only a small producer of tin.

The latest move is the taking of options over idle mines and leases on the Ardlethan tinfield, in New South Wales, 300 miles south-west of Sydney. For nearly 40 years the field was an important tin-mining centre. The ore is cassiterite, associated with pyrite and galena; it occurs in shoots with variable attitude and cross-sectional area, which had a maximum downward extension approaching 1,000 ft. High-grade ore was restricted to the shoots, which were pipe-like in form, but disseminated

low cassiterite distribution extended in places at the upper levels into workable open-cut deposits of relatively limited tonnage. The irregular nature and course of the shoots made prospecting, development, and mining difficult and costly, accentuated by variable tin markets and recurrent droughts and shortage of water, which ultimately led to the abandonment of operations at the three mines. Diamond drilling, with the objective of proving a workable low-grade open-cut proposition, was unsuccessful, but for several years a deep-lead heading from the lodes has been worked. The object of the Aberfoyle company will probably be the delineation of sufficient low-grade material for an open-cut mine and diamond drilling will be planned accordingly.

Treatment in the past was relatively simple, gravity concentration and the cleaning of the resulting concentrate by flotation for removal of the pyrite and galena. The field warrants large-scale prospecting ; its record of production and extension of tin-bearing material is good and there is satisfactory evidence of vertical extension. It can be considered as one of the two most attractive tinfields in the State for re-examination, and it is upon re-examination of the old fields that the future of tin mining in Australia very largely depends.

Iron Ore.—Export of iron ore to Japan continues to be very prominent in Australian mining because of the revenue that may be expected from the sales. This is of particular interest to Western Australia, for that State has a number of relatively-small iron-ore deposits ranging between contents of 1,000,000 tons and 10,000,000 tons. Such deposits have, provisionally, been considered in the export class as being too small to interest Australian iron and steel companies. If development should disclose reserves of sufficient tonnage to interest the Australian industry, however, export of their ore could be cancelled. Sale of ore from any one deposit is limited to a fixed tonnage in the year, so that there is quick and effective control over all occurrences being worked.

Western Australia has granted permits over 27 iron-ore deposits, but the number that will actually be mined depends upon the nature of the development, the tonnage of ore of economic grade proved, and the shipping grade that can be maintained. Other factors are the cost of transport, the rail and/or road construction that must be done to transport ore to the port of shipment, and the cost of equipping a suitable port for loading into ships. These features are being examined by the Japanese buyers in the case of Mount Goldsworthy and Tallering Peak and substantial expenditure will be involved ; this will be linked with the tonnage of available ore located by more intensive exploratory work. Actually the estimated tonnage in most of the lesser deposits is merely provisional. The Mount Goldsworthy deposit, however, has been shown to contain considerably more ore than had been indicated by the preliminary investigation.

The South Australian Government is examining the possibilities of selling ore from a number of small deposits and establishing an export market with Japan. The deposits being examined are all outside the Eyre Peninsula, all ore within that region being excluded from export. Quite recently several small deposits adjacent to the Peterborough–Broken Hill railway have attracted notice. They are conveniently situated for transport, with rail connexion to shipping at Port Pirie or Port Augusta, where shipping facilities are available, without need to incur the cost of harbour works. Several permits have been granted, but, as in the case of Western Australia, the cost of transport will be an important item, accentuated in the case of Western Australia by the cost of harbour works to accommodate the ships that would be engaged in the trade. It can be expected that a large proportion of the prospects in both States will fail to conform to the specifications of the buyers.

Mining Industry.—At the annual meeting of the Australian Mines and Metals Association the president, Mr. M. A. Mawby, said there were firm indications that Australia's mining and metallurgical industry was on the threshold of big advances. Facts suggested that the country is destined to become an important contributor not only to world aluminium output, but also of the mineral resources needed for aluminium production. He emphasized that the traditional impediments to the development of new mining fields are still present. Most new prospects are in isolated regions of the inland and in the north of Australia—areas remote from settlement and all the services which are no bar to industrial development in urban areas. He stressed the need for a Government rôle to aid in overcoming some of these obstacles, which otherwise impose a burden that can cancel the attraction of apparently economic prospects.

Tasmanian Iron.—Tasmania is pushing on with the development of the Savage river iron-ore deposits and is hopeful of establishing, ultimately, a State iron and steel industry. It is claimed that the lodes will contain hematite in excess of 1,000,000 tons when the exploratory programme is completed. Grade of the iron ore

is stated at about 45% iron, but there is a titanium content. The latest move is the shipment to the United States of a tonnage of ore and also of Tasmanian coal for test purposes. A company has been formed to deal with the preliminary investigational and testing work.

An obstacle to rapid development, and one which would add substantially to the capital cost of an enterprise, is the rugged and inaccessible nature of the country. Initial work will be directed to exporting iron ore, but the ultimate objective will be production of steel. In either case a big transport problem must be met to put products on ship.

Brown Coal.—South Australia is giving attention to its deposits of brown coal which occur at Moorlands, north-east of Adelaide. The coal occurrence has been examined and fairly extensively bored in previous years, but has not been developed because of the high overburden–coal ratio, which precluded economic open-cut working. The deposits, which are mostly below water level, have been re-examined with the object of possible establishment of a regional power station. The work, which does not yet lead to a final decision, has shown that about 32,000,000 tons of brown coal are workable by open cut.

The coal is saturated by salt water and cracks and disintegrates on exposure to air. A more detailed examination will be made to determine if mining is justified. The coal seams are narrow and, in this respect, are not comparable with the seams in the Yallourn field or Anglesea, in Victoria. South Australian coal resources are the low-grade sub-bituminous deposit at Leigh Creek, where, on account of the dip of the seams, there is a limit to the tonnage of coal that can be mined by open-cut. This coal is used in the Port Augusta power house and, if the Moorlands coal can be utilized, it will form a valuable addition to the State's power resources.

FAR EAST

August 25.

Malayan Tin Industry.—Malaya's tin production, as shown in official statistics, has been at a higher rate in every one of tbe first six months of 1961 as compared with January to June in 1960. In June, 1961, for example, the tin concentrates produced totalled 106,723 piculs (equal to 6,352 tons) containing 4,807 tons of tin metal, the figure for June, 1960, being 4,298 tons of tin metal. For the first six months of 1961 the cumulative total was 27,130 tons of tin metal against 25,018 tons a year ago. In addition the number of mines has increased and so has the labour force. At June 30, 1961, there were 70 dredges, 515 gravel-pump mines, and 53 other tin mines in operation, while at December 31 last there were 69 dredges, 470 gravel-pump mines, and 52 other tin mines in operation.

Senator Chan Kwong Hon, a Malayan Government delegate to a recent meeting of the International Tin Council in London, was quoted when he returned to Kuala Lumpur as saying that the Malayan Government would produce a strong case for revision of the floor and ceiling prices of tin. In his opinion the producers must be able to work economically on new mining projects and marginal ground, although at the same time the price must be such that it will not accelerate the desire of consumers to rely on substitutes.

Raub Australian Gold.—The Raub Australian Gold Mining Co., Ltd., operator of the only large gold mine in Malaya, is to cease its mining activities. Following advices on the present position at Raub, and after considering all relevant factors, it has been decided that it is no longer possible for the company to carry on.

Refinery for Singapore.—Dr. Goh Keng Swee, Singapore's Finance Minister, inaugurating at Pulau Bukom a (Malayan)$30,000,000 Shell petroleum refinery, said it was completed in the rapid time of 13 months. Mr. N. L. Fakes, chairman of Shell Refining Co. (Singapore), Ltd., said the success achieved in constructing the refinery would encourage his firm to probe other possible projects for building in Singapore. " To get construction know-how here on the spot in Singapore we have relied on our main contractors, Lummus Company, Ltd., of New York."

Indonesia.—Colonel Rudy Pirngardie, president-director of Indonesian Government mining enterprises, said in Jakarta that Indonesia may be smelting tin for other countries in a few years' time. This statement follows a decision that Indonesia's first tin smelter is to be built on Banka island. When completed the smelter is expected to be capable of processing all of Indonesia's domestic requirements. A contract for construction of the smelter was signed recently by Colonel Pirngardie and Mr. Rudolf Jahnig, representing the West German firm of Blockner Industrie-Anlagen.

Pakistan Oil.—A contract for the supply of Russian equipment and services of Russian experts to Pakistan for oil and gas exploration was signed recently in Karachi. The contract provides for the training of a large number of Pakistani nationals in all spheres of oil exploration.

SOUTHERN AFRICA

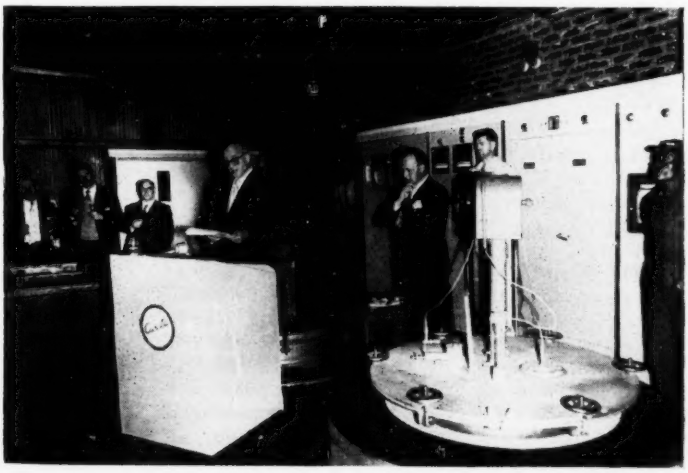
August 27

Union Affairs.—Cautiously more optimistic comment in Johannesburg now is that the worst of the chilling economic and financial breezes that have been numbing investment planning and development have virtually blown themselves out. However, there are as yet few signs of positive initiative in the private sector, which remains largely based on a hold-the-line attitude and looks to official quarters, if not for a lead, at any rate for promotion and provision of conditions that would reduce the risk-factors to acceptable limits. Perhaps a more positive outlook in the private sector will develop after the October elections. Meanwhile the man-in-the-street is keeping his hands well down into his pockets, as much to keep them warm as to hold on to some lingering small change. It would seem that, if there is any place worth-while marching on or to at the moment, it is Pretoria. Chiselling has reached such a peak of refined art that sculptors are walking around looking for work.

In his annual address the Governor of the S.A. Reserve Bank—Dr. M. H. de Kock—commented that the real cause of the 1960-1961 balance of payments deficit was the continued outflow of capital. It could not be attributed to excessive imports relative to exports, for, even after allowing for an increase of R44 million in net current invisible payments, the current trading account still reflected a R38 million surplus. He estimated the 1960-1961 net capital outflow at R112 million against R164 million in the previous year, entirely in the private sector. Supplementing the intensification of various control measures the Government applied for and was granted standby credits of R54 million by the International Monetary Fund and the Reserve Bank itself availed itself of short-term credit from an overseas bank of R14 million and encouraged certain domestic institutions to accept overseas loans offered (of which about R9 million has already been received).

Commenting on the sales of South African securities on the Johannesburg Stock Exchange, the Governor indicated that the resulting outflow of capital had obviously dampened new enterprise in the country, absorbed local savings, reduced the availability of equity capital, depressed prices on the Johannesburg Stock Exchange, and increased dividend yields which discouraged new investment. He also indicated that the intensificati of controls was a necessary prelude to obtaining the I.M.F. standby credit which should dispel fears of devaluation and for the promotion of conditions facilitating considerable repayments of loans over the next three years without relying on renewals or new loans and credit or new direct investment from overseas.

In the course of inaugurating the new carburizing furnace at the works of Avesta South Africa (Pty.), Ltd., on July 28, which furnace—the third to be installed—carburizes 12-ft. rod-lengths, Dr. H. J. van Eck gave as his view that some of South Africa's engineering shops might consider turning their experience and competitive ability to good account in markets beyond South Africa's borders. He had in mind both highly-developed countries like the United



New Carburizing Plant Opened

States and Canada as well as countries like many in South America, where, while manufacturing industries have not yet been developed to quite such a high degree, there is a great deal of advanced mining development going on in copper, lead, and zinc, and particularly in iron-ore mining. Africa's export possibilities also apply to Africa and Asia and here, affirmed Dr. van Eck, " we have to think in terms of the future as well as the somewhat uncertain and unsettled present."

The African continent at present produces 98·5% of the world's diamonds, over 80% of the world's cobalt minerals, over 30% of the chrome ore, over 20% of antimony, 19% of manganese, and of cadmium, 14% of tin, over 10% of zinc, almost 10% of lead, 5% of the silver, and not least over 55% of the world's gold, said Dr. van Eck, as well as 45% of the world's beryllium minerals and 29% of the world's crude phosphates, but only a little over 3% of the world's iron-ore production. During the recent South African trade mission to South America it was found that the country's mining, railway, and other equipment can compete very well with supplies from other parts of the world and it is hoped that exports of iron and steel to the Argentine can continue or even increase substantially in the future.

The Avesta company has adopted the trade-name of " Fulkarb " for its fully-carburized products of which mining duties in Southern Africa range from the Copperbelt ore-bodies, tests in kimberlite, to iron ore and Witwatersrand banket in the south, as well as to the west at the O'okiep Copper and in asbestos mining. A recent application has been to long-hole stoping in certain Rand gold mines, where 60 ft. to 100 ft. by 2-in. diameter holes are drilled from reef drive to reef drive, using an anti-deflection rod that holes within 2 in. of planned. Reduction in drilling costs have been of the order of 30% to 70%. In Southern Africa Avesta products are distributed by Holman Bros., Ltd.

Gold.—The No. 4 shaft of Hartebeestfontein Gold Mining has intersected the Vaal Reef at 6,600 ft., a full exposure around the perimeter averaging 187 in.-dwt. This 24-ft. lined-diameter shaft, downcast for ventilation, will have four operating compartments and one service compartment for the transport of men, materials, rock, and ore. Expected to be commissioned by the year-end or shortly thereafter, the shaft will facilitate an expansion of the milling rate well into the 130,000 to 160,000 tons-a-month range, possibly higher; against the average monthly milling of 136,000 tons in the second quarter. The main benefit will be in the higher tonnage milled rather than in grade and yield, which in the second quarter averaged 9·184 dwt. a ton.

Two further bore-hole results from the southern section of the lease area of President Brand Gold Mining add further confirmation to expectations that, while reasonable values persist southwards from No. 2 shaft, there is a considerable fall-off in the extreme southern section. In the first bore-hole, about 6,200 ft. S.S.E. of No. 2 shaft, values of 493, 403, and 285 in.-dwt. were disclosed; in the second, 11,900 ft. S.S.E. of the same shaft and near the southern boundary values of 63, 71, and 54 in.-dwt. were obtained. Including these values the average bore-hole grade range for the lease area becomes about 470 to 800 in.-dwt., and payability about 50% to 75%. The last ore-reserve grade was 18·04 dwt. over a stoping width of 53·89 in. and the mill yield in the second 1961 quarter 15·68 dwt. per ton.

In the south eastern section of the lease area of President Steyn Gold Mining a recent bore-hole disclosed the satisfactory values of 330,307 and 265 in.-dwt. at 6,540–3 ft., about 5,900 ft. south-east of No. 2 shaft. Including these results the indicated bore-hole grade range for the lease area becomes 325 to 400 in.-dwt. approximately and the payability range about 55% to 60%. The last ore-reserve grade was 8·03 dwt. over a stoping width of 45·78 in., while the mill yield in the second 1961 quarter was 7·49 dwt. per ton.

If not already in commission the No. 3 shaft system—comprising a 26 ft. diameter hoisting component sunk to 6,255 ft. and a 20 ft. ventilation component sunk to 6,010 ft.—should shortly be in full operational duty. This will equalize the hoisting duties of the mine's three shafts, two of which have been operating at above normal capacity rates, pending the operational commissioning of No. 3, which is equipped with a steel A-type headframe. Benefits from the commissioning of No. 3 shaft will include an extension and acceleration of the development rate, increased stoping and hoisting of ore, and a significant rise in the milling rate.

South-West Africa.—It is now reported that the first operations of the newly-formed Marine Diamond Corporation will be directed towards deep-sea dredging. There are believed to be promising off-shore deposits.

From the end of August the manganese workings of S.A. Minerals Corporation, Ltd., in the Okahandja area have been on a care and maintenance basis, following a lengthy period of exploratory development. This apparently did not result in any disclosures altering what seems to be the basic characteristic of the deposits—

namely, erratic mineralization requiring extensive selective mining, or quarrying to obtain grades conforming to export requirements.

Pig-Iron.—Finality is awaited in negotiations between African Metals Corporation, Ltd., and leading Japanese steel interests (reported to include the Yawata Iron and Steel Co. and Mitsui Busnan Kaisha) for the supply of about 50,000 tons a year of pig-iron and ferro-alloys over a period of 10 years from 1964. A successful conclusion to the negotiations would mean expansion of the output capacity of the corporation's iron-ore workings in the Postmasburg area, as well as the possible expansion of its blast-furnace capacity at its Newcastle, Natal works. The pig-iron price is stated to be R35 per ton c.i.f.

Basutoland Protectorate.—Henceforth the right to peg diamond claims in the territory will be reserved to Basutos only. A new agreement is reported to have been reached between the Basutoland authorities and Mr. J. Scott regarding his concession in the Leribe area, where his rights have been sustained. Associated with Mr. Scott in his venture is the Anglo American Corporation, which has been providing technical assistance. Many of the Basuto holders of claims and diggers are stated to be financed by whites and at the moment the general position seems somewhat confused. This suggests that centralized buying of Basuto diamond production may be in the offing. This will almost certainly be done if production becomes appreciable.

Coal Prospecting.—The South African Iron and Steel Industrial Corporation, Ltd., is intensifying its programme of prospecting and exploratory development in the Waterberg–Zoutpansberg area of the Northern Transvaal. In the Waterberg zone of the coalfield, where substantial tonnages of bituminous and blend coking coal have been indicated by drilling, a shaft sunk by the Department of Mines is being re-opened and will be recommissioned for underground exploratory development. In the Zoutpansberg area further drilling is being conducted with a 10-in. core drill to obtain samples for coking and blending tests.

Bechuanaland Protectorate.—A geological survey of surface indications of possible oil occurrences is now being conducted by a team of United States and South African geologists, which, if results are favourable, will be followed by deep drilling.

Trade Notes

Brief descriptions of developments of interest to the mining engineer

50 Years of Drilling

To mark their golden jubilee a booklet has been produced which recalls some interesting history of the development of drill steels by **Padley and Venables, Ltd.,** of Dronfield, Sheffield. The company started in 1911 as R. Padley and Co. and first became known as the sole suppliers of one-piece drill steels to the Ingersoll-Rand Co. A subsequent stage came in 1928 when a start was made in business with Holman Bros., Ltd., which in 1932 led to the development of the Riley (detachable) bit, later known as the Rip-Bit. Mr. G. Riley was at that time chairman of Holman's Canadian company. A company called Rip-Bits, Ltd., was formed in which Consolidated Pneumatic Tool Co., Ltd., also had an interest.

The later development of the " P.M." bit is then recalled and its derivation from Padley and Morgan. Mr. George Morgan, who has been with the company since 1919, has for some years been managing director of the firm, which became a public company in 1947. The P.M. bit became a great influence in South Africa where it was manufactured under licence,

production figures at one time reaching a total of 1,000,000 per week.

From 1945 onwards the major development was, of course, the coming of tungsten carbide for the tipping of bits and one-piece stems and the company's connexion with this development is interestingly told in the review of the period.

The opening of a London office in 1950, where contact is maintained with interested parties and liaison with bodies such as the British Compressed Air Society and the British Engineers Association, with the London director, Mr. E. A. Martin in charge, marks a culminating point in a successful growth from small beginnings.

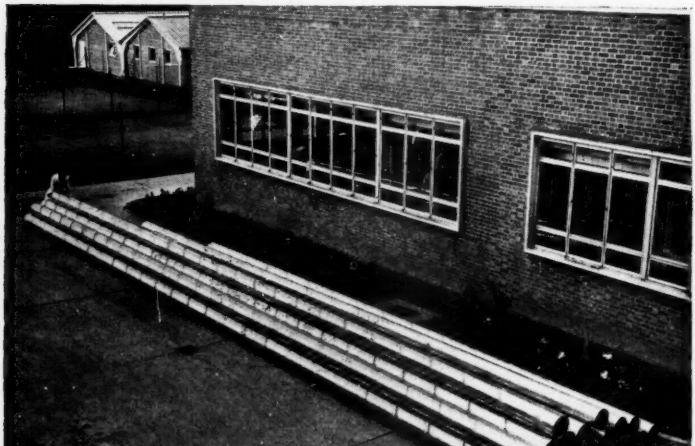
Belt Covering Radioactively Controlled

At the Leyland factory of **BTR Industries, Ltd.,** radioactive gauges now record and control the thickness of PVC coating being applied to fire-resistant underground conveyor belting. Some 4,500-ft. of similar PVC belting—incorporating a continuous filament nylon stress member with a cotton cover warp and continuous filament nylon weft—has been supplied by the company for Pit House Drift, Durham, one of the National Coal Board's largest and most important installations. This newly-patented method of construction, it is stated, represents a major departure from conventional methods.

Radioactive Gauges in Use.

Helical-Weld Aluminium Pipe

Large-scale production of aluminium pipe in sizes up to 28 in. diamter is now possible due to the successful adaptation to aluminium of the helical-weld method of tube making. Until now the two main types of aluminium tubing that were available in large quantities, extruded and



Helical-Weld Aluminium Pipe.

drawn seamless tubing, have been limited by practical considerations to a maximum diameter of approximately 12 in.

The method of making helical-weld tube consists essentially of feeding metal strip into formers or a series of rollers set at an angle so that the strip describes a helix as it travels through the machine. The resulting helical seam is then welded continuously and automatically. The tubing can be made to considerable lengths and to accurate limits. Because of the increasing demand for thin-walled aluminium pipe in large diameters **Alcan Industries, Ltd.** (then Northern Aluminium Co.), undertook in 1959 in collaboration with others a programme of development work on the production of helical-weld aluminium tube. The close tolerances to which aluminium strip is supplied permit welding to take place under excellent edge matching conditions. This is an important point which has contributed significantly to the success in making this pipe of consistently high quality. Moreover, welding is faster with aluminium than with steel and the high speeds possible lead to high rate of output and low manufacturing costs.

Personal

D. BLEACKLEY has returned from British Guiana.

BARRY CROWSTON has been appointed an assistant director of technical information for the Climax Molybdenum Company.

K. J. DELL is shortly returning from Nigeria.

L. F. DENARO is to succeed Mr. A. C. STURNEY as general manager of publicity to the International Nickel Co. (Mond), Ltd.

J. L. FARRINGTON is now in Nigeria.

M. I. FREEMAN has now been appointed chairman of the Imperial Smelting Corporation, Ltd.

H. N. HART has been appointed a director of the General Mining and Finance Corporation, Ltd.

A. R. HILTON has been appointed mining projects engineer to Eimco (Great Britain), Ltd.

G. S. KEAT has returned from Sierra Leone.

H. A. LONGDEN has been appointed a director, deputy chairman, and chief executive of the Cementation Co., Ltd.

C. P. A. LOUWRENS, now a consulting mechanical engineer to the Anglo American Corporation in Johannesburg, has been appointed to succeed Mr. A. H. W. BUSBY, the Corporation's consulting mechanical engineer in Rhodesia, who is retiring on December 31 next. Mr. Busby is to remain a further three months in the Salisbury office, it is stated, to complete his responsibilities in connexion with the new I.S.F. Plant at Rhodesia Broken Hill and development work at Rhodesia Congo Border Power Corporation.

M. A. MAWBY has been appointed chairman of Consolidated Zinc Proprietary, Ltd.

C. W. MILNER is now in Ghana.

T. O. MORRIS is home from South Africa.

J. A. NOTTAGE has left the O.F.S. for Northern Rhodesia.

E. T. PINKNEY, at present consulting chemical engineer in the Anglo American Corporation's head office at Johannesburg, has been appointed consulting metallurgist (development) in Salisbury, with effect from January 1, 1962. He will work in conjunction with Mr. F. H. CHAPMAN, the Corporation's consulting metallurgist in Rhodesia.

A. C. STURNEY has been elected a director of the International Nickel Co. (Mond), Ltd.

R. L. TACHON is returning from Colombia.

A. L. THOMAS has been appointed a director of Pengkalen, Ltd.

Metal Markets

During August [1]

Copper.—The feature which has characterized the copper market in August has been a pronounced stability in prices during a month which has seen a total stoppage of all the big mines in Chile.[2] This stoppage, it may be added, is still continuing and does not appear likely to end in the very near future. In the early part of the month the matter was still in suspense, as the originally-threatened deadline of August 1 was not adhered to, following agreement to a postponement. After this had elapsed on August 10, however, a strike broke out at the El Salvador and Potrerillos properties and was backed by a solidarity strike at El Teniente and Chuquicamata, despite such action having been declared illegal. On every occasion up to now when a strike of such seriousness has broken out in Chile the London market has been quick to respond with improved prices. On this occasion, however, prices were not merely unimpressed by these developments; they remained most obstinately within a pound or two of previous levels. The reasons for such action are perfectly good and are the combined result of long-term

[1] Recent prices, pp. 136, 176.
[2] See Table, p. 176.

and local factors. The long-term factor is quite simply that there is still a world surplus of copper, not only in terms of heavy stocks in producers hands, but, perhaps more significantly, in terms of certain large producers still operating production restrictions. These represent a large reserve supply for world markets in the event of any calamitous reduction in supplies (and the Chilean stoppage nearly comes in this category). Indeed the availability of such material is excellent, in view of the fact that one at least of the restricting concerns is producing through to the metal stage before holding supplies from the market. The strength of these conditions was demonstrated by a further bout of rigid stability, following the news that a minor labour dispute had precipitated a strike at the Bingham mine, in the U.S.A.

Copper consumption in the U.K. in June was 63,694 tons, bringing the half year to the moderate figure of 356,058 tons, of which 270,387 tons was refined. Production of primary refined was 12,814 tons and of secondary refined 10,543 tons. The half-year totals are respectively much better and slightly better than in the same period of 1960. End of month stocks were 125,608 tons of refined and 19,659 tons of blister.

Tin.—August has seen tin prices move strongly and, on the whole, fairly resolutely towards the £1,000 a ton mark, although attainment of the latter during the month was not reached.[1] It is possible that prices would have shown much the same performance, at any rate on balance, even if particular developments in the market had been quite different from those that in fact took place in August. As it was, the main particular factor was the announcement, to the surprise of most, that the International Tin Council meeting scheduled for August 22 was being postponed until mid-September. With the market in a state of extreme sensitivity due to the large number of speculative accounts now open, this news was at first received with some dismay and a decline in prices. This proved, however, an operation which the French would describe as *reculer pour mieux sauter*, as, after a small amount of tin in weak hands had moved across the market in the following few days, a renewed surge of confidence carried prices strongly forward to within only a few pounds a ton of the £1,000 mark.

At this level there has been a further round of profit taking, which is not surprising in view of prices already being £100 a ton higher than they were when many people went long of tin by buying from the buffer stock manager at £880 a ton. At the same time the detached opinion must remain that a further improvement in tin prices can hardly fail to take place, even without the question of any anticipation of decisions to be taken at the Tin Council meeting when it is finally held. The basic world statistical position is a decidedly strong one, as there is no indication where the tin will come from that will offset the gap that seems bound to arise between supply and demand. Reflecting this, the one additional source of tin to the market—the sale by the U.S. Government of metal from its non-strategic holdings—has been most successful after a shaky start only a few weeks ago. The latest offer of 1,000 tons was all acquired at strong prices.

Consumption of tin in the U.K. in June was 1,822 tons, so that the half year is almost 11,000 tons and not far below the same period of 1960. Proportionately production in the half year is slightly down at 13,123 tons. End of June stocks were 9,151 tons.

Lead.—The feature of lead in August has been the final confirmation of the promised barter deal of a total of 100,000 tons of Canadian and Australian lead for U.S. grain. It is so long since this deal was first mooted (in April), and almost equally long since the last indication that negotiations were satisfactorily proceeding, that receipt of the news had a tonic effect on lead, if an improvement of at most £2 a ton can be described in such generous terms.[1]

U.K. lead consumption in June was 32,966 tons, keeping the half-year total at 189,064 tons, close to the comparable period of 1960. Production was 7,656 tons, and end month stocks were 69,510 tons.

Zinc.—Zinc was quite devoid of new developments in August, unless one takes account of moves made in the U.S.A. to attempt to subsidize production by small U.S. lead and zinc producers. However, these have not so far come to any concrete result. The immediate outlook for consumption is not particularly exciting, but for the long term one must still allow that zinc has a much better potential than lead.[1]

United Kingdom June consumption was 30,671 tons, giving the depressing half-year total of 176,726 tons. The decrease was entirely in high grades of zinc, g.o.b. having actually increased. June production was 8,774 tons and stocks stood at 67,796 tons.

Iron and Steel.—The British steel industry is slowly gathering momentum following the holiday period slow down. The position this year, however, differs considerably from others, when the industry had to work hard to make up for the annual pause. Generally, the order load

See Table, p. 176.

[1] See Table, p. 176.

is fairly light and consumers are showing restraint in placing new business. This is mainly the result of the abundance of capacity which enables users to obtain steel at very short notice. The policy of reducing stocks is also a factor. Although steel output in the past two months or so has been below last year's level consumption of steel has shown little change. Activity in heavy engineering continues at an impressive rate, but the motor industry is still going through a quiet patch, while the news from the shipyards is gloomy.

In an attempt to offset the sluggish demand from home customers steelmakers are paying more attention to overseas markets. Considerable efforts will have to be made if they are to increase exports, however, as competition from other steelmaking countries is very intense. Total shipments this year have been slightly above 1960. An outstanding success in this field recently was the Steel Company of Wales order to supply 11,200 tons of tinplate to the west coast of the United States. The company hopes that regular shipments to that area will now be possible. The Welsh company was also in the news in August over its application to import American coking coal. This was rejected by the Government, but it is not expected to be the last word on this controversial subject.

Iron Ore.—Owing to large stocks and a drop in consumption imports of iron ore into the United Kingdom this year have been at a lower rate compared with the record intake in 1960. In the first seven months of this year arrivals declined by almost 800,000 tons to 9,300,000 tons.

Aluminium.—Conditions in the aluminium market in August have continued rather depressed and decidedly competitive. U.K. domestic consumption has continued at a low ebb, in line with the lower figures for first half 1961 consumption, which have been received in the same period.

Nevertheless there has appeared to be no abatement in the industry's enthusiasm for the long-term picture. To take only two of various developments which were revealed during the month, expansion of primary production in Canada is envisaged and also of semi-fabricating in Europe. The Canadian project involves expansion of the Baie Comeau plant of Canadian British Aluminium, a subsidiary of British Aluminium, by a further 50% over present capacity of 90,000 short tons a year. Although the Canadian plant falls in the orbit of the Reynolds Metals Group of the U.S.A., it seems likely that the expansion is designed to provide metal for the British parent, as has been done with production from Baie Comeau up to now. In Belgium Reynolds Metals Co. has joined with local interests to form Aleurope, which is to be a new semi-fabricating company having in particular a rolling mill.

In the context of latest moves for the U.K. to join the Common Market, and bearing in mind Reynolds Metals big stake in the market here through British Aluminium, this move can hardly been seen entirely as ensuring the group a foothold in the Common Market. It must represent also simply a desire to ensure participation in the envisaged expansion in aluminium consumption on the Continent of Europe.

Antimony.—Over the past month the antimony metal and ore markets have shown a somewhat drifting tendency. The Russians and Chinese have continued to press their sales of antimony and the price for the latter has fallen. Prices have, however, been maintained at the same level as for July for 60% ore at from 26s. to 28s. per unit c.i.f. Domestically-produced 99% regulus is still quoted at £230 per ton and 99·6% at £237½ per ton.

Arsenic.—The general position of arsenic has remained fairly dull throughout August. The price of metallic arsenic in the U.K. is still held at £400 per ton and of arsenic trioxide at £40 to £45 per ton.

Cobalt.—The cobalt market has remained quite reasonable throughout the past month, although it is still apparent that there will be a world surplus for some considerable time. Contract supplies of metal continue to change hands within the U.K. at 10s. 9d. per lb. and to others the price remains at 12s.

Cadmium.—Within the U.K. the current price of cadmium remains at 11s. per lb., despite indications early in the month that the opportunity to implement the long-awaited rise in prices might be arising. The state of the market has been somewhat better over the past month or so, but it has shown, as yet, little of its traditional buoyancy this year.

Chromium.—The state of chromium has remained unchanged throughout August and prices are still quoted in the range of 6s. 11d. to 7s. 4d. per lb.

Tantalum.—The strength of the market continued throughout August as was shown by a leading U.S. tantalum foil producer announcing a proposed increase of 50% in production. The price rose from the 1,000s. to 1,200s. level of recent weeks to 1,200s. to 1,300s. per unit c.i.f. for a good 60% ore.

Platinum.—The platinum market has been somewhat steady throughout August and the big producers have continued to meet contractual demands of their customers. The U.K. prices

remain the same at £30¼ per oz. and imported at £27½ to £28 per oz.

Iridium.—The iridium market has been quiet in the extreme throughout the past month. The summer period is now coming right to the tail end, but it is not clear whether there will be any change in the not too distant future. The U.K. price has been held steadily throughout August at £20 to £26¾ per troy oz.

Palladium.—There has been no change in palladium throughout the month and the U.K. price has been maintained at £8½ to £9¾ per troy oz.

Osmium.—Trading in osmium has remained quite uninteresting throughout August and the price remains the same at £17 to £25 per troy oz.

Tellurium.—The future of this metal remains bright. There has been no change in the price of powder, which remains at 37s. 6d. per lb. Sticks are still quoted at 40s. per lb. The market has remained healthy.

Tungsten.—The tungsten-ore market has remained quiet throughout August, with only very small and irregular periods of activity. The price is now quoted at 126s. to 130s. Scheelite has continued in more active demand than wolframite throughout the month.

Nickel.—The consumption of nickel has been reasonably steady throughout the month and the price is still quoted at £600 per ton.

Chrome Ore.—The official Turkish export price for chrome ore remains at $30 per ton f.o.b. Rhodesian metallurgical remains at £15¼ per ton c.i.f. Last month's report of the impending railway bottleneck in Southern Rhodesia does not seem to have been fully borne out yet; at the present time the movement of ore does not seem particularly restricted.

Molybdenum.—The market for molybdenite during August remained as strong as it has been during the past two years or so allowing for seasonal considerations. The price remains at 10s. per lb. Mo, f.o.b.

Manganese.—The price for manganese ore is now indicated in the range of 66d. to 69d. per long ton unit of Mn, c.i.f., following a reduction in the Indian liner freight rate. This has, however, only served to maintain the relation of Indian offering prices to other competitive sources.

Tin, Copper, Lead, and Zinc Prices

Tin, minimum, 99·75%; Copper, electro; Lead, minimum, 99·75%; and Zinc, minimum, 98%, per ton.

Date	Tin		Copper		Lead		Zinc	
	Settlement	3 Months	Spot	3 Months	Spot	3 Months	Spot	3 Months
	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.
Aug. 11	933 0	942 15	230 7½	234 2½	64 11¼	66 1¼	76 18¾	77 16¼
14	933 10	944 5	231 2½	234 12½	64 13¾	66 1¼	76 16¼	77 16¼
15	942 0	951 10	230 2½	233 12½	64 8¾	66 1¼	76 16¼	77 16¼
16	942 0	954 15	230 17½	234 2½	64 6¼	65 16¼	76 16¼	77 16¼
17	943 0	954 10	230 12½	233 17½	64 1¼	65 13¾	76 18¾	77 18¾
18	937 0	947 15	230 7½	233 12½	63 15	65 8¾	76 16¼	77 16¼
21	945 0	954 15	231 12½	234 7½	64 1¼	65 11¼	76 6¼	77 6¼
22	947 10	957 5	231 17½	234 17½	64 5	65 16¼	75 6¼	76 6¼
23	961 0	969 10	230 17½	234 2½	64 6¼	65 16¼	75 1¼	76 3¾
24	961 0	969 0	229 12½	233 7½	64 11¼	66 3¾	74 16¼	75 16¼
25	964 0	968 15	231 15	234 12½	65 1¼	66 13¾	74 12½	75 13¾
28	978 0	981 10	232 7½	235 2½	65 7½	67 1¼	74 18¾	75 18¾
29	992 0	992 10	232 7½	235 7½	65 7½	67 3¾	75 11¼	76 8¾
30	987 0	987 10	232 7½	235 12½	65 3¾	66 16¼	76 6¼	77 2½
31	983 0	985 10	232 7½	235 17½	64 18¾	66 13¾	76 3¾	76 16¼
Sept. 1	993 0	993 10	232 17½	236 2½	64 12½	66 6¼	75 11¼	76 8¾
4	991 0	992 10	234 7½	237 7½	64 12½	66 6¼	75 6¼	76 5
5	982 0	987 10	234 12½	237 17½	64 6¼	65 16¼	75 5	76 3¾
6	941 0	952 10	233 5	236 12½	64 3¾	65 16¼	74 8¾	76 8¾
7	954 0	963 10	232 7½	235 17½	64 3¾	65 17½	74 8¾	75 3¾
8	—	—	—	—	—	—	—	—

Statistics

TRANSVAAL AND O.F.S. GOLD OUTPUTS

	July		August	
	Treated Tons	Yield Oz.*	Treated Tons	Yield Oz.†
Blyvooruitzicht	138,000	86,324	145,000	89,906
Brakpan	146,000	18,605	146,000	18,888
Buffelsfontein‡	152,000	66,439	155,000	68,022
City Deep	121,000	23,636	117,000	23,760
Cons. Main Reef	39,000	8,974	39,000	8,739
Crown Mines	178,000	31,131	184,000	32,242
Daggafontein	228,000	46,008	224,000	45,361
Dominion Reefs	40,000	240	41,300	35
Doornfontein‡	125,000	53,500	124,000	53,630
D'rb'n Roodeport Deep	200,000	37,024	202,000	37,869
East Champ D'Or‡	12,500	351	12,500	231
East Daggafontein	108,000	18,421	108,000	18,523
East Geduld	124,000	34,844	129,000	36,249
East Rand P.M.	230,000	55,449	254,000	58,137
Eastern Transvaal Consol	20,400	5,898	20,200	6,078
Ellaton‡	23,000	5,468	23,000	5,498
Freddies Consol	65,000	13,512	65,000	13,443
Free State Geduld	99,500	86,565	99,500	87,026
Free State Saaiplaas	60,000	16,445	62,000	16,988
Geduld	80,000	12,805	81,000	13,060
Government G.M. Areas‡	34,000	6,268	35,000	7,965
Grootvlei Proprietary	220,000	45,490	227,000	46,935
Harmony Gold Mining	202,000	81,302	202,000	37,869
Hartebeestfontein‡	136,000	62,560	136,000	62,560
Libanon	119,000	30,255	119,000	30,290
Loraine	85,000	26,350	85,000	27,625
Luipaards Vlei‡	110,000	13,831	110,000	14,299
Marievale Consolidated	99,000	23,760	102,000	24,225
Modderfontein East	61,000	6,360	63,000	6,470
New Kleinfontein	69,000	10,027	72,000	10,126
New Klerksdorp‡	—	—	—	—
President Brand	130,000	100,866	132,000	102,391
President Steyn	110,000	41,421	111,000	41,933
Rand Leases	192,000	26,112	192,000	26,112
Randfontein‡	136,000	9,996	110,000	9,525
Rietfontein Consolid't'd	12,000	3,170	12,000	3,149
Robinson Deep	45,000	9,929	52,000	9,951
Rose Deep	23,000	4,072	27,000	4,245
St. Helena Gold Mines	188,000	65,806	190,000	66,507
Simmer and Jack	71,000	12,384	72,000	12,344
S. African Land and Ex.	111,000	22,255	110,000	22,185
S. Roodepoort M.R.	30,000	7,250	31,000	7,515
Spaarwater Gold	11,200	3,563	11,200	3,604
Springs	94,000	13,883	96,000	14,131
Stilfontein Gold Mining‡	182,000	81,900	185,000	83,065
Sub Nigel	66,500	15,022	66,500	15,142
Transvaal G.M. Estates	—	—	—	—
Vaal Reefs‡	114,000	53,295	116,000	54,230
Van Dyk Consolidated	74,000	11,348	77,000	11,214
Venterspost Gold	127,000	38,227	128,000	39,040
Village Main Reef	36,800	4,324	36,200	4,344
Virginia O.F.S.‡	143,000	28,457	140,000	26,896
Vlakfontein	53,000	19,597	53,000	19,640
Vogelstruisbult‡	80,000	17,244	80,000	17,312
Welkom Gold Mining	104,000	32,607	105,000	33,531
West Driefontein‡	180,000	140,402	182,000	142,783
West Rand Consol.‡	219,000	22,463	222,000	22,861
Western Holdings	175,000	121,222	175,000	122,063
Western Reefs	155,000	45,184	155,000	45,182
Winkelhaak	96,000	32,640	99,000	33,660
Witwatersrand Nigel	19,300	4,273	19,400	4,277

* 251s. 8d. † 250s. 3d. ‡ Gold and Uranium.

COST AND PROFIT IN THE UNION *

	Tons milled	Yield per ton	Work'g cost per ton	Work'g profit per ton	Total working profit
		s. d.	s. d.	s. d.	£
June, 1960	17,968,300	73 9	46 3	27 6	31,941,743
July	—	—	—	—	—
August	—	—	—	—	—
Sept.	18,103,100	74 0	46 4	27 8	32,201,685
Oct.	—	—	—	—	—
Nov.	—	—	—	—	—
Dec.	17,272,800	76 2	47 0	29 2	33,039,583
Jan., 1961	—	—	—	—	—
Feb.	—	—	—	—	—
Mar.	17,858,100	—	—	—	31,924,315
April	—	—	—	—	—
May	—	—	—	—	—
June	18,419,350	—	—	—	65,772,460†

* 3 Months. † R.

PRODUCTION OF GOLD IN SOUTH AFRICA

	Rand and O.F.S.	Outside	Total
	Oz.	Oz.	Oz.
August, 1960	1,778,711	36,777	1,815,488
September	1,774,967	35,352	1,810,319
October	1,777,495	35,967	1,813,462
November	1,775,624	36,159	1,811,783
December	1,744,406	34,044	1,778,450
January, 1961	1,785,614	34,407	1,820,021
February	1,759,373	32,046	1,791,419
March	1,837,280	38,843	1,876,123
April	1,837,511	29,437	1,866,948
May	1,885,415	42,062	1,927,477
June	1,887,594	35,858	1,923,452
July	1,899,248	34,977	1,934,225

NATIVES EMPLOYED IN THE SOUTH AFRICAN MINES

	Gold Mines	Coal Mines	Total
November 30, 1960	367,658	33,052	400,710
December 31	364,407	32,791	397,198
January 31, 1961	384,816	33,513	418,329
February 28	396,533	33,577	430,110
March 31	398,626	33,736	432,362
April 30	398,012	34,005	432,017
May 31	396,437	33,587	430,024
June 30	392,591	33,180	425,771
July	389,255	33,200	422,455

MISCELLANEOUS METAL OUTPUTS

	4-Week Period To Aug. 19		
	Tons Ore	Lead Concs. tons	Zinc Concs. tons
Broken Hill South	20,900	3,357	4,278
Electrolytic Zinc	19,924	1,025	6,019
Lake George	17,658	1,237	2,545
Mount Isa Mines**	54,747	3,000†	4,684
New Broken Hill	55,853	4,534	11,765
North Broken Hill	32,210	6,686	6,608
Zinc Corp.	49,897	6,146	8,651†
Rhodesia Broken Hill*	—	—	—

* 3 Months, ** Copper 3,210 tons blister; 6,312 tons concs.; † Metal.

RHODESIAN GOLD OUTPUTS

	July		Aug.	
	Tons	Oz.	Tons	Oz.
Cam and Motor	—	—	—	—
Falcon Mines	22,350	4,826	21,700	4,253
Globe and Phœnix	4,700	2,628	4,940	2,653
Motapa Gold Mining	—	—	—	—
Mazoe	2,755	—	2,856	—
Coronation Syndicate	12,178	—	12,851	—
Phœnix Prince*	—	—	35,830	3,247

* 3 Months.

WEST AFRICAN GOLD OUTPUTS

	July		Aug.	
	Tons	Oz.	Tons	Oz.
Amalgamated Banket	—	—	—	—
Ariston Gold Mines	—	—	—	—
Ashanti Goldfields	38,500	32,500	38,000	32,750
Bibiani	—	—	—	—
Bremang	—	—	—	—
Ghana Main Reef	—	—	—	—
Kononga	8,010	4,321	8,010	4,374
Lyndhurst	—	—	—	—

PRODUCTION OF GOLD AND SILVER IN RHODESIA

	1960		1961	
	Gold (oz.)	Silver (oz.)	Gold (oz.)	Silver (oz.)
January	44,902	29,711	47,673	22,101
February	45,754	29,865	44,164	13,250
March	45,309	29,656	52,507	7,256
April	48,607	6,847	50,090	7,992
May	47,542	62,912	—	—
June	45,884	34,298	—	—
July	44,865	33,323	—	—
August	48,284	28,931	—	—
September	48,865	38,951	—	—
October	47,473	37,308	—	—
November	46,439	33,896	—	—
December	48,778	26,327	—	—

WESTRALIAN GOLD PRODUCTION

	1959	1960	1961
	Oz.	Oz.	Oz.
January	63,924	64,794	62,434
February	65,035	66,789	73,271
March	65,408	61,941	69,360
April	62,686	65,373	62,569
May	64,184	66,682	66,352
June	74,590	74,902	81,562
July	78,974	67,623	61,886
August	68,546	67,466	—
September	66,501	68,794	—
October	70,427	67,310	—
November	68,858	107,815	—
December	117,474	76,269	—
Total	861,122	855,758	—

AUSTRALIAN GOLD OUTPUTS

	4-Week Period			
	To July 18		To Aug. 15	
	Tons	Oz.	Tons	Oz.
Central Norseman	14,011	7,580	13,489	7,438
Gold Mines of Kalgoorlie	41,577	11,058	40,783	12,374
Gt. Boulder Gold Mines*	—	—	—	—
Gt. Western Consolidated	33,883	5,045	33,323	4,475
Lake View and Star*	226,120	51,898	—	—
North Kalgurli	30,169	7,572	—	—
Sons of Gwalia	12,496	3,064	—	—
Mount Morgan	—	5,609	—	4,380

* 3 Months.

ONTARIO GOLD AND SILVER OUTPUT

	Tons Milled	Gold Oz.	Silver Oz.	Value Canad'n $
March, 1960	804,309	229,457	37,202	7,646,044
April	779,487	218,393	42,997	7,426,262
May	784,391	225,550	32,174	7,765,153
June	791,488	223,833	40,765	7,756,490
July	779,426	222,179	37,002	7,664,968
August	712,792	202,025	35,722	6,883,254
September	772,984	208,019	29,251	7,114,785
October	805,753	228,914	33,808	7,860,787
November	785,133	230,377	31,149	7,917,352
December	783,501	229,639	37,560	8,020,961
January, 1961	804,026	227,771	27,776	7,901,743
February	737,859	214,763	33,291	7,465,046
March	814,951	234,228	34,181	8,128,958
April	770,931	225,836	32,949	7,842,394
May	794,700	233,162	34,071	8,088,356
June	762,113	210,470	33,080	7,626,339

MISCELLANEOUS GOLD AND SILVER OUTPUTS

	July		Aug.	
	Tons	Oz.	Tons	Oz.
Clutha River	—	543	—	493
Lampa (Peru)†	—	53,640	—	31,784
New Guinea Goldfields	4,112	1,043	—	—
Yukon Consol.	—	$368,000	—	—

† Oz. Silver : Copper, 158 tons ; 101 tons.

AUSTRALIAN BASE-METAL OUTPUTS

Period	Concentrate Production (Long Tons)		
	Zinc	Copper (*a*)	Lead
1960	290,596	104,889	297,510
Provisional 1960—January	15,070	8,169	15,540
February	26,716	8,265	26,437
March	27,535	9,680	26,146
April	23,759	9,548	21,279
May	29,032	9,017	28,155
June	—	—	—
July	—	—	—
August	—	—	—
September	—	—	—
October	—	—	—
November	—	—	—
December	—	—	—

(*a*) includes Cu content of direct smelting ore.

OUTPUTS OF MALAYAN TIN COMPANIES IN LONG TONS OF CONCENTRATES

	June	July	Aug.
Ampat Tin	75	64	60
Austral Amalgamated	—	—	—
Ayer Hitam	571*	—	—
Berjuntai	301½	364	320
Chenderiang	65*	20	—
Gopeng Consolidated	471*	153	171
Hong Fatt (Sungei Besi)	—	—	—
Hongkong Tin	192*	65	—
Idris Hydraulic	65*	22	25
Ipoh	11½	—	—
Kampong Lanjut	174	146½	163
Kamunting	171	177	144
Kent (F.M.S.)	95*	42	36
Kepong	147*	—	—
Killinghall	60*	25	—
Kinta Kellas	14½	13	11
Kramat	43	41	35½
Kuala Kampar	108	105½	125
Kuala Lumpur	—	—	—
Kuchai	—	—	—
Larut	21½	19	20
Lower Perak	121	133	93½
Malayan	630½*	213½	173
Pacific Tin Consolidated	—	—	—
Pahang Consolidated	632*	—	—
Pengkalen	146*	38	58
Petaling Tin	81	103	110
Rahman Hydraulic	—	—	—
Rambutan	55*	19	19
Rantau	72	79½	64
Renong	272*	—	—
Selayang	4*	—	—
Siamese Tin Syndicate (Malaya)	5	38	38
Southern Kinta	426	454	412
Southern Malayan	859*	335	340
Southern Tronoh	—	—	—
Sungei Besi	372*	—	—
Sungei Kinta	—	—	—
Sungei Way	415*	—	—
Taiping Consolidated	28	32	32½
Tanjong	131*	75	66½
Tekka	—	—	—
Temoh	—	—	—
Tongkah Harbour	130	148	145
Tronoh	1131*	—	—

* 3 Months.

NIGERIAN MINE OUTPUTS (TONS)

	June	July
Cassiterite	685	818
Columbite	159	192
Felspar	—	—
Gold*	69	67
Kaolin	—	—
Lead Ore	—	—
Limestone	37,083	32,672
Monazite	1	1
Oil	169,629	237,361
Tantalite	—	—
Thorite	—	44
Tin Metal	65	—
Wolfram	—	—
Zircon	82	83

* Oz.

MISCELLANEOUS TIN COMPANIES' OUTPUTS IN LONG TONS OF CONCENTRATES

	July		August	
	Tin	Columbite	Tin	Columbite
Amalgamated Tin Mines	332	74	387	—
Anglo-Burma Tin*	—	—	—	—
Bangrin	31	—	17	—
Beralt	3	180†	3	185†
Bisichi	54	60	—	—
Ex-Lands Nigeria	50	—	47	—
Fabulosa	62	—	—	—
Geevor	60	—	41	—
Gold and Base Metal	67	5	—	—
Jantar Nigeria	18	36	16½	33½
Jos Tin	14	—	—	—
Kaduna Prospectors	6	—	7	—
Kaduna Syndicate	29	—	25	—
Katu Tin	5	—	14	—
Kefn Tin	—	—	—	—
London Nigerian Mines	—	—	—	—
Mawchi Mines	—	—	—	—
Naraguta Extended	—	—	—	—
Naraguta Karama	6½	—	—	—
Naraguta Tin	—	—	—	—
Ribon Valley (Nigeria)	—	—	—	—
Siamese Tin Syndicate	113	—	95	—
South Bukeru	—	—	—	—
South Crofty	80	—	40	—
Tavoy Tin	—	—	—	—
Tin Fields of Nigeria	—	—	—	—
United Tin Areas of Nigeria	17½	1	—	—

* 3 Months. † Wolfram.

SOUTH AFRICAN MINERAL OUTPUT

June, 1961.

Gold	1,923,184 oz.
Silver	198,203 oz.
Diamonds	486,020 carats.*
Coal	3,854,697 tons.
Copper	(*a*) 9 tons in matte and copper-gold concentrates. (*b*) 4,631 tons of 98·45%.
Tin	263 tons concs.
Platinum (concentrates, etc.)	—
Platinum (crude)	—
Asbestos	18,084 tons.
Chrome Ore	90,461 tons.
Manganese Ore	135,814 tons.
Lead Concs.	31 tons.

* *May, 1961.*

IMPORTS OF ORES, METALS, ETC., INTO UNITED KINGDOM

		June	July
Iron Ore	tons	1,519,042	1,381,293
Manganese Ore	,,	48,838	20,819
Iron and Steel	,,	41,740	49,619
Iron Pyrites	,,	27,938	22,793
Copper Metal	,,	58,604	43,167
Tin Ore	,,	3,809	4,928
Tin Metal	,,	80	255
Lead	,,	19,373	16,479
Zinc Ore and Conc.	,,	15,036	29,864
Zinc	,,	13,737	9,847
Tungsten Ores	,,	594	363
Chrome Ore	,,	11,731	25,795
Bauxite	,,	38,973	100
Antimony Ore and Concs.	,,	1,077	27
Titanium Ore	,,	27,869	15,284
Zirconium Ores and Concs.	,,	1,080	3,963
Tantalite/Columbite	,,	20	139
Sulphur	,,	40,707	35,624
Barytes	,,	4,020	1,818
Asbestos	,,	22,587	15,018
Magnesite	,,	14,713	11,809
Mica	,,	801	420
Graphite	,,	485	709
Mineral Phosphates	,,	97,304	88,987
Molybdenum Ore	,,	544	129
Silicon	,,	591	644
Nickel	cwt.	24,987	15,387
Aluminium	,,	537,503	443,232
Mercury	lb.	245,385	171,342
Bismuth	,,	—	73,882
Cadmium	,,	221,449	243,263
Cobalt and Cobalt Alloys	,,	238,953	271,420
Selenium	,,	26,601	9,047
Petroleum, Crude	1,000 gal.	1,009,643	1,079,914

Prices of Chemicals

The figures given below represent the latest available.

		£	s.	d.
Acetic Acid, Glacial	per ton	104	0	0
,, ,, 80% Technical	,,	94	0	0
Alum, Comml.	,,	25	0	0
Aluminium Sulphate	,,	16	5	0
Ammonia, Anhydrous	per lb.		1	6
Ammonium Carbonate	per ton	59	0	0
,, Chloride	,,	30	2	6
,, Nitrate	,,	36	5	0
Antimony Sulphide, golden	per lb.		4	4
Arsenic, White, 99/100%	per ton	47	10	0
Barium Carbonate 98–99%	,,	42	0	0
,, Chloride	,,	45	0	0
Barytes (Bleached)	,,	20	0	0
Benzene	per gal.		5	6
Bleaching Powder, 35% Cl.	per ton	30	7	6
Borax	,,	46	10	0
Boric Acid, Comml.	,,	77	10	0
Calcium Carbide	,,	40	17	9
,, Chloride, solid, 70/75%	,,	17	0	0
Carbolic Acid, crystals	per lb.		1	2
Carbon Bisulphide	per ton	62	10	0
Chromic Acid	,,	245	0	0
Citric Acid	per cwt.	8	14	0
Copper Sulphate	per ton	78	0	0
Creosote Oil (f.o.r. in Bulk)	per gal.		1	3
Cresylic Acid, refined	,,		8	2
Hydrochloric Acid 28° Tw.	per carboy		13	6
Hydrofluoric Acid, 59/60%	per lb.		1	1
Iodine	per kilo		17	4
Iron Sulphate	per ton	3	5	0
Lead, Carbonate, white	,,	112	5	0
,, Nitrate	,,	114	0	0
,, Oxide, Litharge	,,	101	5	0
,, Red	,,	99	5	0
Lime Acetate, brown	,,	40	0	0
Lithopone	,,	57	10	0
Magnesite, Calcined	,,	20	0	0
,, Raw	,,	13	0	0
Magnesium Chloride	,,	20	0	0
,, Sulphate, Comml.	,,	15	10	0
Methylated Spirit, Industrial, 66 O.P.	per gal.		5	10½
Nickel Sulphate	per ton	207	0	0
Nitric Acid, 70° Tw.	,,	35	0	0
Oxalic Acid	,,	132	0	0
Phosphoric Acid (S.G. 1·750)	per lb.		1	4
Potassium Bichromate	per ton	131	16	8
,, Bromide	per lb.		2	6
,, Carbonate (hydrated)	per ton	72	10	0
,, Chloride	,,	21	0	0
,, Iodide	per kilo		19	3
,, Hydrate (Caustic) flake	per ton	92	0	0
,, Nitrate	per cwt.	3	10	0
,, Permanganate	,,	10	3	0
,, Sulphate, 50%	per ton	21	4	6
Sodium Acetate	,,	63	0	0
,, Arsenate, 58–60%	,,	Nominal		
,, Bicarbonate	,,	18	0	0
,, Bichromate	,,	109	13	4
,, Carbonate (Soda Ash) 58%	,,	16	0	0
,, Chlorate	per ton	90	0	0
,, Cyanide	per cwt.	6	18	10
,, Hydrate, 98/99%, solid	per ton	35	6	6
,, Hyposulphite, Comml.	,,	35	0	0
,, Nitrate, Comml.	,,	Nominal		
,, Phosphate (Dibasic)	,,	40	10	0
,, Prussiate	per lb.		1	0½
,, Silicate	per ton	16	0	0
,, Sulphate (Glauber's Salt)	,,	12	5	0
,, ,, (Salt-Cake)	,,	10	0	0
,, Sulphide, flakes, 60/62%	,,	40	12	6
,, Sulphite, Comml.	,,	27	15	0
Sulphur, American, Rock (Truckload)	,,	13	0	0
,, Ground, Crude	,,	17	10	0
Sulphuric Acid, 168° Tw.	,,	12	0	0
,, ,, free from Arsenic, 140° Tw.	,,	8	10	0
Superphosphate of Lime, 18% P_2O_5	,,	13	10	0
Tin Oxide	,,	Nominal		
Titanium Oxide, Rutile	,,	172	0	0
,, White, 25%	,,	85	0	0
Zinc Chloride	,,	95	0	0
,, Dust, 95/97% (4-ton lots)	,,	121	10	0
,, Oxide	,,	95	10	0
,, Sulphate	,,	32	0	0

Share Quotations

Shares of £1 par value except where otherwise stated.

GOLD AND SILVER:	Aug. 8, 1961 £ s. d.	Sept. 6, 1961 £ s. d.
SOUTH AFRICA:		
Blinkpoort (5s.)	2 1 6	2 1 9
Blyvooruitzicht (2s. 6d.)	1 5 6	1 5 0
Bracken (10s.)	1 0 9	1 0 3
Brakpan (3d.)	3 6	4 0
Buffelsfontein (10s.)	1 12 6	1 13 0
City Deep	13 6	13 0
Consolidated Main Reef	13 0	13 0
Crown Mines (10s.)	19 3	18 9
Daggafontein (5s.)	18 6	17 9
Dominion Reefs (5s.)	18 9	19 6
Doornfontein (10s.)	1 6 6	1 6 6
Durban Roodepoort Deep (10s.)	1 5 0	1 5 9
East Champ d'Or (2s. 6d.)	1 9	1 6
East Daggafontein (10s.)	9 0	9 0
East Geduld (4s.)	14 3	14 6
East Rand Ext. (5s.)	16 9	17 6
East Rand Proprietary (10s.)	1 5 3	1 4 3
Freddies Consol.	1 6	2 0
Free State Dev. (5s.)	3 3	3 3
Free State Geduld (5s.)	3 17 6	4 0 0
Free State Saaiplaas (10s.)	4 0	4 3
Geduld	2 3 0	2 2 6
Government Gold Mining Areas (3d.)	1 6	1 9
Grootvlei (5s.)	17 3	16 6
Harmony (5s.)	1 2 0	1 1 9
Hartebeestfontein (10s.)	2 1 3	2 1 3
Libanon (10s.)	13 3	13 3
Loraine (10s.)	17 3	16 9
Luipaards Vlei (2s.)	7 6	7 9
Marievale (10s.)	1 3 6	1 4 3
Modderfontein B (3d.)	1 3	1 3
Modderfontein East	7 0	7 6
New Kleinfontein	4 0	4 9
New Pioneer (5s.)	1 7 6	1 8 3
New State Areas (15s. 6d.)	6	6
President Brand (5s.)	2 13 3	2 13 3
President Steyn (5s.)	15 3	15 3
Rand Leases (9s. 3d.)	3 9	3 9
Randfontein	17 6	18 0
Rietfontein (3d.)	2 6	2 3
Robinson Deep (3d.)	4 0	3 9
Rose Deep (3d.)	5 6	5 6
St. Helena (10s.)	2 19 3	2 18 9
Simmer and Jack (1s. 6d.)	9	9
South African Land (3s. 6d.)	13 3	14 0
Springs (3d.)	1 0	1 0
Stilfontein (5s.)	1 7 0	1 6 6
Sub Nigel (3d.)	6 9	7 0
Vaal Reefs (5s.)	1 17 6	1 17 6
Van Dyk (3d.)	1 3	1 6
Venterspost (10s.)	19 3	18 6
Virginia (5s.)	2 6	2 6
Vlakfontein (10s.)	15 3	14 6
Vogelstruisbult (3d.)	3 3	3 3
Welkom (5s.)	11 0	12 6
West Driefontein (10s.)	3 18 9	3 17 6
West Rand Consolidated (10s.)	14 9	15 3
West Witwatersrand Areas (2s. 6d.)	2 10 0	2 10 0
Western Holdings (5s.)	6 2 6	5 17 0
Western Reefs (5s.)	1 4 0	1 3 6
Winkelhaak (10s.)	18 6	19 6
Witwatersrand Nigel (2s. 6d.)	6	6
Zandpan (10s.)	7 6	6 9
RHODESIA:		
Cam and Motor (2s. 6d.)	—	—
Chicago-Gaika (10s.)	12 6	12 6
Coronation (2s. 6d.)	3 6	3 6
Falcon (5s.)	7 6	7 6
Globe and Phœnix (5s.)	1 10 0	1 9 6
Motapa (5s.)	—	—
GHANA:		
Amalgamated Banket (3s.)	—	—
Ariston Gold (3s. 6d.)	—	—
Ashanti Goldfields (4s.)	12 9	13 0
Bibiani (4s.)	—	—
Bremang Gold Dredging (5s.)	—	—
Ghana Main Reef (5s.)	—	—
Konongo (2s.)	1 0	9
Kwahu (2s.)	4 3	4 6
Offin River (2s. 6d.)	1 9	1 9
Western Selection (5s.)	3 6	3 9
AUSTRALASIA:		
Gold Fields Aust. Dev. (3s.), W.A.	2 0	2 0
Gold Mines of Kalgoorlie (10s.)	9 6	8 9
Great Boulder Propriet'y (2s.), W.A.	12 3	12 3
Lake View and Star (4s.), W.A.	1 4 9	1 3 6
Mount Morgan (10s.), Q.	12 3	11 6
New Guinea Gold (4s. 3d.)	1 3	1 3
North Kalgurli (1912) (2s.), W.A.	10 6	10 0
Sons of Gwalia (10s.), W.A.	2 9	2 6
Western Mining (5s.), W.A.	1 1 9	19 0

	Aug. 8, 1961 £ s. d.	Sept. 6, 1961 £ s. d.
MISCELLANEOUS:		
Fresnillo ($1·00)	1 16 3	2 2 6
Kentan Gold Areas	18 3	16 3
St. John d'el Rey, Brazil	4 6 3	3 17 6
Yukon Consolidated ($1)	3 4½	3 3
COPPER:		
Bancroft Mines (5s.), N. Rhodesia	13 6	12 3
Esperanza (2s. 6d.), Cyprus	1 9	1 9
Indian (2s.)	5 9	5 6
MTD (Mangula) (5s.)	7 0	7 0
Messina (5s.), Transvaal	13 9	13 3
Mount Lyell (5s.), Tasmania	6 0	6 0
Nchanga Consolidated, N. Rhodesia	2 7 3	2 6 3
Rhokana Corporation, N. Rhodesia	2 7 3	2 6 0
Roan Antelope (5s.), N. Rhodesia	5 3	5 3
Tanganyika Concessions (10s.)	1 1 6	1 0 0
LEAD-ZINC:		
Broken Hill South (1s.), N.S.W.	13 6	13 0
Burma Mines (3s. 6d.)	1 9	1 6
Consol. Zinc Corp. Ord.	3 13 9	3 8 6
Lake George (5s.), N.S.W.	3 0	3 0
Mount Isa, Queensland (5s. Aust.)	2 14 6	2 18 6
New Broken Hill (5s.), N.S.W.	2 11 0	2 10 3
North Broken Hill (10s.), N.S.W.	18 6	17 6
Rhodesia Broken Hill (5s.)	7 0	7 3
San Francisco (10s.), Mexico	18 6	18 3
TIN:		
Amalgamated Tin (5s.), Nigeria	11 9	12 3
Ampat (4s.), Malaya	16 3	16 3
Ayer Hitam (5s.), Malaya	2 15 0	2 9 0
Beralt (5s.), Portugal	1 6 6	1 8 0
Bisichi (2s. 6d.), Nigeria	5 0	5 0
Ex-Lands (2s.), Nigeria	4 0	4 0
Geevor (5s.), Cornwall	1 4 0	1 7 3
Gold Base Metals (2s. 6d.), Nigeria	1 9	2 0
Hongkong (5s.), Malaya	1 5 6	1 5 0
Jantar Nigeria (3s.)	5 9	5 6
Kaduna Syndicate (2s.), Nigeria	2 9	2 10
Kamunting (5s.), Malaya	18 9	18 6
Malayan Tin Dredging (5s.)	1 19 0	1 14 0
Mawchi Mines (4s.), Burma	1 3	1 6
Naraguta Karama (5s.), Nigeria	1 0	1 0
Pahang (5s.), Malaya	18 9	17 6
Siamese Synd. (5s.)	1 0 9	19 6
South Crofty (5s.), Cornwall	5 9	6 6
Southern Kinta (2s.), Malaya	1 6 6	1 3 0
Southern Malayan (5s.)	1 13 9	1 12 6
Sungei Besi (4s.), Malaya	2 10 0	2 6 0
Sungei Kinta, Malaya	15 6	15 0
Sungei Way (2s. 4d.), Malaya	5 6	5 0
Temoh (7s. 6d.), Malaya	4 9	4 0
Tronoh (5s.), Malaya	3 15 0	3 7 6
United Tin Areas (2s. 6d.), Nigeria	1 9	1 9
DIAMONDS:		
Anglo American Investment	12 2 6	12 5 0
Consol African Selection Trust (5s.)	15 9	16 0
Consolidated of S.W.A. Pref. (10s.)	8 0	9 0
De Beers Deferred (5s.)	6 6 3	6 15 0
FINANCE, Etc.		
African & European (10s.)	2 10 0	2 10 0
Anglo. American Corporation (10s.)	6 5 0	6 8 3
Anglo Transvaal 'A' (5s.)	1 8 9	1 8 6
British South Africa (15s.)	3 4 0	2 19 6
British Tin Investment (5s.)	—	1 0 0
Broken Hill Proprietary	2 16 9	2 15 0
Camp Bird (10s.)	5 6	5 6
Central Mining	1 14 6	1 4 6
Central Provinces Manganese (10s.)	14 9	16 9
Consolidated Gold Fields	2 13 6	2 10 9
Consolidated Mines Selection (10s.)	1 6 9	1 5 3
Corner House	9 9	10 6
East Rand Consolidated (5s.)	1 9	1 9
Free State Development (5s.)	3 3	3 3
General Exploration O.F.S. (2s. 6d.)	2 9	2 9
General Mining and Finance	3 19 0	4 2 6
Hendersons (4s.)	7 6	7 0
Johannesburg Consolidated	2 2 0	2 2 0
London & Rhod. M. & L. (5s.)	7 6	7 9
London Tin Corporation (4s.)	19 6	1 0 0
Lydenburg Est. (5s.)	8 9	10 0
Marsman Investments (10s.)	2 7½	2 7½
National Mining	1 9	2 0
Rand Mines (5s.)	2 19 0	2 18 9
Rand Selection (5s.)	2 0 0	1 18 9
Rhodesian Anglo American (10s.)	2 17 3	2 15 3
Rhodesian Corporation (5s.)	2 0	1 9
Rhodesian Selection Trust (5s.)	9 3	9 0
Rio Tinto (10s.)	1 14 3	1 14 3
Selection Trust (10s.)	4 19 3	4 18 0
South West Africa Co. (3s. 4d.)	11 3	8 3
Union Corporation (2s. 6d.)	2 11 6	2 9 0
Vereeniging	4 13 9	4 16 3
West Rand Inv. Trust (10s.)	2 5 0	2 3 9

THE MINING DIGEST

A RECORD OF PROGRESS IN MINING, METALLURGY, AND GEOLOGY

In this section abstracts of important articles and papers appearing in technical journals and proceedings of societies are given, together with brief records of other articles and papers; also notices of new books and pamphlets and lists of patents on mining and metallurgical subjects.

Cupriferous Peat in New Brunswick

A paper by D. C. Fraser in the *Canadian Mining and Metallurgical Bulletin* for July is entitled "Cupriferous Peat: Embryonic Copper Ore." In his introduction the author notes that a peat swamp in south-eastern New Brunswick is noted for its unusually high copper content. The swamp is located in the Tantramar Marshes, about seven miles north of the town of Sackville, Westmorland County. Termed the Tantramar copper swamp, it is at an elevation of 50 ft. above sea level. The swamp is bordered on the north and west by gently rolling hills, which were burned over in 1955, and on the south and east by a thick lowland forest. The copper swamp has an area of 2½ acres, of which one acre is open (the clearing) and the remainder covered by evergreens growing on waterlogged soil (the swampy forest). The bulk of the copper is contained in the forest peat, which overlies weakly mineralized sandy loam and ground morainal material. Mr. G. P. Mackay of Halifax studied the economic aspects of this cupriferous peat and arranged limited testing with a pilot mill in an attempt to determine the most economical method of copper recovery. Some 300 tons of copper were estimated to occur in the swamp, but extraction of the metal appears too costly to warrant the financial risks involved in such a low-tonnage mining venture.

The accumulation of copper in the Tantramar swamp, the author says, was recognized many years ago. The oddity of the peat muck was first noted when a farmer attempted to fertilize his cucumbers with this rich black peat. The dose proved lethal. The accumulation of copper appears unique. Several copper swamps are known to occur, but all contain macroscopic lumps and aggregates of native copper in peat of acidic pH. In the Tantramar swamp, however, the copper substance is invisible and the pH of the peat varies from subneutral to slightly alkaline. Methods using bromoform and isodynamic techniques in conjunction with X-ray analysis failed to identify the copper substance. Largely because of these negative results it is believed that the metal is not present as sulphide oxide or as native copper. The most reasonable hypothesis regarding the nature of the copper substance assumes that the metal is bound organically, thus forming a chelate compound.

Heavy-metal analysis of the water in the vicinity of the swamp showed clearly that the cupriferous solutions enter the swamp as water seepages in the clearing. Nearby streams are not carrying the copper from its primary source to the site of deposition in the swamp.

A generalized vertical section shows the forest peat contains a maximum of 10% copper, dry weight. In spite of this a thick growth of evergreens and other plants occurs, apparently protected to a large extent by the few inches of low-metal humus (which averages about ½% copper).

The clearing is characterized by an almost complete absence of vegetation, probably the result of copper toxicity. The points of entry of the cupriferous solutions occur in the few water seepages in the clearing. It is suggested that above these seepages the pre-existing forest peat absorbed the greatest amounts of copper, resulting in the death of the overlying flora. This clearing is continuously widening at the expense of the swampy forest.

Rain and seepage waters have eroded peat in the clearing and partly exposed the underlying sandy loam and glacial morainal material. The dislodged peat was removed from the swamp *via* an outflowing streamlet.

The characteristic features of the Tantramar copper swamp are as follows:—

(1) A large variety of plants grow on the swampy forest. Apparently these are protected from the toxic peat by a few inches of humus containing about 0·5% copper.

(2) The bulk of the copper is contained in the forest peat. This peat underlies the humus and

overlies the sandy loam. The copper content of the peat usually varies from 2% to 5%, but may be as high as 10% of the dry weight of the soil.

(3) The sandy loam beneath the peat in the swampy forest and at the surface in the clearing averages 0·25% copper. However, the copper content of this material in the water seepages averages 1% copper. The movement of copper in the mobile state appears to be influenced chiefly by capillarity, evaporation, and the growth of frost crystals. These phenomena tend to raise the cupriferous solutions to the surface, thus bringing them into contact with the forest peat.

The primary source of the copper in the swamp is not readily apparent. There is no known bedrock copper occurrence in the vicinity of the cupriferous swamp. The nearest known copper deposit is that of the old Dorchester mine 7½ miles south-west of the swamp. This deposit is of the " redbed " type, occurring in the Pennsylvanian Boss Point formation. There is reason to believe that the Boss Point was deposited along with slightly cupriferous pyrite, with supergene processes yielding local enrichments such as are found at the old Dorchester mine.

The primary source of the Tantramar copper is probably associated with the Boss Point formation. This formation underlies the swamp at an estimated depth of 200 ft. Thus it is assumed that circulating ground waters are dissolving copper from occurrences within the Boss Point formation. These cupriferous solutions emerge through seepages in the clearing of the Tantramar swamp. As the solutions filter through the peat, the metal is immobilized or " fixed ". The fixation process is probably of an organic nature, because the bulk of the copper is contained in the organic sediments—*i.e.*, peat—rather than in the predominantly clastic sediments—*i.e.*, sandy loam and ground morainal material.

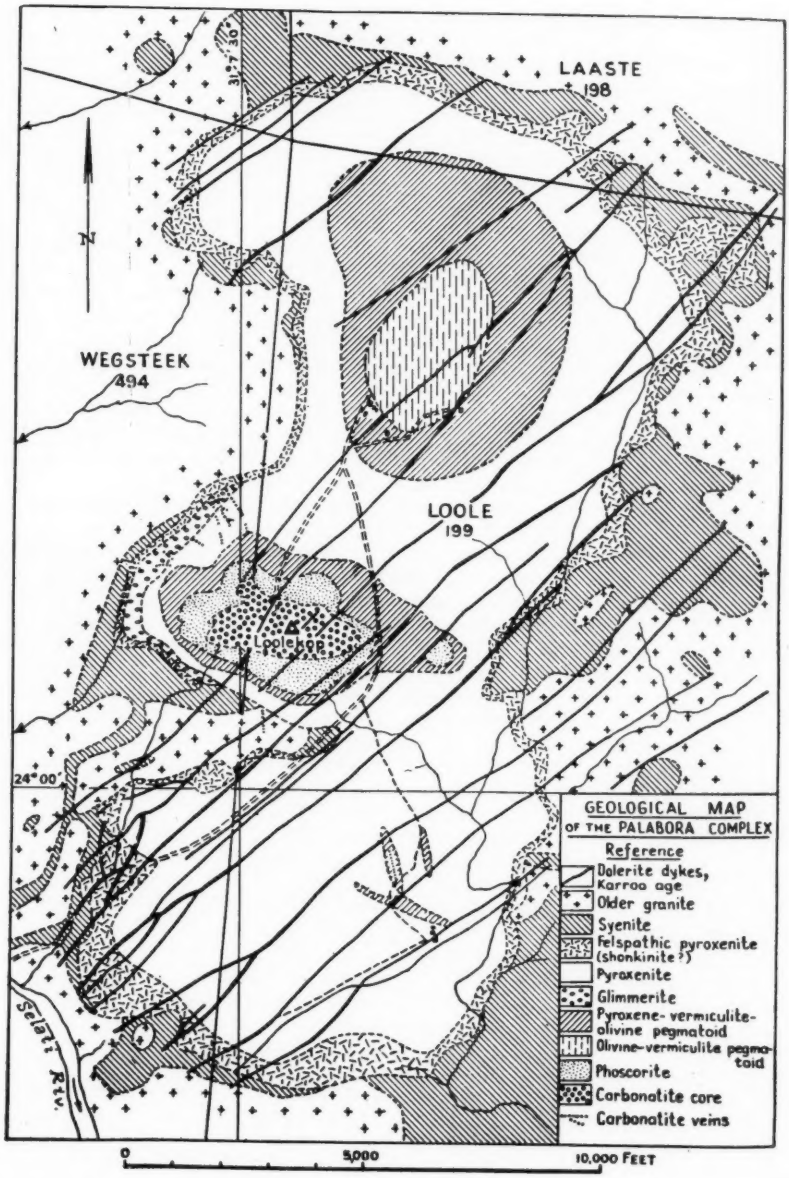
The evaluation of the rôle played throughout geological history by this type of copper concentration is, of course, the author says, wholly conjectural. An isostatic lowering of the land and/or a eustatic rise in sea level might result in the flooding of the Tantramar region. If this should happen the sea water over the swamp could well become sulphurous, as this low-lying area would inhibit free circulation of the water and the abundance of organic matter would effect the evolution of H_2S and HS. In such an environment the copper would be converted to sulphide and, if subsequent deposition covered and preserved the organic sediments, a stratigraphically narrow bed of mineralized black shale might result, having characteristics similar to those of certain portions of the Kupferschiefer. Such a process may have contributed to the formation of the carbonaceous sediments containing bedded copper deposits which are found sporadically throughout the geological column.

Of the many factors which may be influential in the fixation of the copper it is suggested that phenomenon of chelation is probably the most important. In such a process the metal would be bonded to the nitrogen and oxygen components of the forest peat. The fixation of the copper by a chelation mechanism is not definitely established. However, such a process conveniently accounts for the relative restriction of the metal to the organic sediments, the difficulty of visually identifying the copper compound, and the inability of the writer to separate a copper-bearing substance from the forest peat.

Applying the concept of uniformitarianism to the Tantramar copper swamp it is suggested that the chelation phenomenon may have been a factor in the localization of copper deposits in the geological past.

The Loolekop Carbonatite Plug

A note on the deposit at Phalaborwa, in the north-eastern Transvaal, at present being extensively explored by the Palabora Mining Company, appears in the *South African Mining and Engineering Journal* for August 4. The Loolekop deposit, it is stated, is in the form of a pipe with an approximately elliptical cross-section and vertical side walls and an area of some seven square miles. It lies a few miles north-west of the junction of the Selati and Olifants rivers and the eastern limit is less than a mile from the western boundary of the Kruger National Park. The country rock is old granite. The pipe grades upwards from pyroxenite, which comprises about 96% of the outcrop, through foskorite (3% of the deposit area) to the central core of carbonatite (2%). The core forms



Loolekop, the only hill in the area. The foskorite contains about 25% by weight of apatite (10·5% P_2O_5). The pyroxenite body contains approximately 17% apatite and two rich occurrences of vermiculite, one of which is being worked by the Transvaal Ore Co. The carbonatite body contains copper minerals associated with magnetite (F_3O_4) and titanium. Magnetite also exists in the foskorite, to the extent of about 30% by weight.

On Loolekop there are numerous old-working slag heaps, and smelting furnaces, showing that copper was mined either by ancient peoples or Bantu tribes which subsequently left the area.

Primitive smelting of magnetite for iron was also done.

The first exploitation of the phosphate potential of the area was the recovery of pure apatite by hand picking. Subsequently South African Phosphates, Ltd., in the early 1930's, erected a plant for crushing and grinding the apatite-bearing rock and the concentration of the phosphatic material by flotation. After sieving the product was sold as a raw rock phosphate. Marketing difficulties, however, were encountered and operations ceased in 1934. Further investigations into the area were carried out and work done on a suitable method of recovery. In 1951 the South African Government took over the phosphatic claims from the Transvaal Ore Co. and Palabora Phosphate and Vermiculite, and the Phosphate Development Corporation (Pty.), Ltd. (FOSKOR), was established under the aegis of the Industrial Development Corporation. Production of phosphates on a large scale started in March, 1955.

Open-cast mining with 25-ft. cuts is employed. A normal blast uses about 16 cases of explosives to break some 4,000 tons of ore. This is loaded by 1½-cu. yd. mechanical shovels into 15-ton diesel trucks and transported to the mill a mile away. The run-of-mine ore is crushed in 60-in. by 48-in. jaw-crushers to *minus* 10-in. Secondary and tertiary crushing until recently was carried out with impact crushers, but these have been replaced by gyratory cone-crushers to increase the throughput from 200 tons to 300 tons an hour. Grinding is done by two rod-mills, the second of which is in closed circuit with two hydrocyclone classifiers. The pulp then passes to wet magnetic separators to remove the magnetite. This is pumped to a dump some 500 yd. from the plant.

The non-magnetite overflow, containing mainly apatite, calcite, and silicates such as serpentine and vermiculite, is recycled in closed circuit with a low-pressure hydrocyclone and an 8-ft. by 8-ft. rod-mill. The overflow from the hydrocyclone is collected in a thickener for thickening and desliming. The underflow from the thickener is pumped by diaphragm pumps at 40% solids into a sump, from where it is transferred *via* a pulp splitter into two conditioners. A 10% caustic soda solution is added as an alkalinity regulator and depressant for vermiculite and other silicates and Tall Oil as a promotor-collector for apatite.

The conditioned pulp is then pumped to the flotation cells. In these air bubbles collect the apatite which rises to the surface as a froth and the gangue material sinks. The overflow containing the apatite is dewatered by filtration and dried in an oven. The final product which is about 90% pure mineral is sold to various fertilizer manufacturing companies.

Current monthly production is approximately 12,000 tons. It is planned to increase this in stages to the country's entire requirement of some 50,000 tons a month of 37% P_2O_5 grade.

According to the 1959 edition of the Mineral Resources of the Union of South Africa the ore reserves as prospected around the western end of Loolekop on a strike length of 2,500 ft. and down to the valley level is estimated at 11,200,000 tons, with an average phosphoric oxide content of 10% in the main body of foskorite peripheral to the carbonatite core. In addition, for every 100 ft. below the 1,325-ft. level 10,000,000 tons of ore exist, assuming that the orebody has the same areal extent with increase in depth. As to persistence at depth a borehole sunk in 1957 to 475 ft. below the 1,325-ft. level yielded higher than average phosphoric acid content.

Largely as a result of the possible strategic importance of uranium thorianite, a prospecting programme was undertaken in 1953 of the carbonatite plug at Loolekop by the Department of Mines. This established the existence of a large low-grade copper deposit. Following on this extensive exploration was initiated by Mineral Search of Africa (Pty.), Ltd. This was followed by the formation of the Palabora Mining Co., under the management of Rio Tinto Management Services (S.A.), whose major shareholders are the Rio Tinto Company and Newmont Mining Corporation.

Over the past four years a surface drilling programme, involving a total of 120,000 ft., has proved the existence of an orebody to a depth of 1,000 ft. containing several hundreds of million tons of ore. Following on laboratory tests, indicating that in certain circumstances acceptable recoveries of copper in concentrates can be achieved, the pilot plant with a capacity of 100 tons a day has been installed for bulk sampling and metallurgical testing. This plant will provide the data necessary to make an economic appraisal of the project and a decision whether or not to go ahead with full-scale development of the deposit will probably be taken in the latter part of next year.

As mentioned earlier, magnetite containing titanium is associated with the copper. The titanium content increases outwards from the centre to the fringes of the deposit. Tests are in progress to ascertain whether a proportion of the magnetite has a sufficiently low Ti content to make it a commercially acceptable product.

Recovery of Scandium

The recovery of scandium from uranium solutions at the plant of the Vitro Chemical Company, Salt Lake City, is described by L. D. Lash and J. R. Ross in *Mining Engineering* for August. The authors say that the small amounts of scandium occurring in uranium ores are dissolved during acid leaching. When the Vitro Chemical Company, they say, converted their uranium plant from phosphate precipitation to solvent extraction, scandium was found to follow the uranium into the dodecyl phosphoric acid solvent (DDPA). However, scandium did not strip with uranium from the DDPA in hydrochloric acid, but remained in the solvent. Therefore, a concentration of scandium built up in the organic phase. Residues from the solvent were spectrographed by the United States Bureau of Mines and found to contain scandium.

As a result of this discovery provisions were made in the plant for recovery of scandium-bearing concentrates. Solvent extraction of uranium was added to a conventional acid leach process in a typical installation. The ore was crushed and ground, and then leached with dilute sulphuric acid. Addition of an oxidant such as sodium chlorate insured conversion of uranium minerals to a soluble form. At this point the slurry was chemically reduced by a sulphide, such as sodium hydrosulphide, to remove substances such as ferric iron and molybdenum which were partially extracted by the solvent. The solids-liquid separation was accomplished by a four-stage CCD thickener circuit. The uranium was extracted from pregnant liquor with 0·1M DDPA in kerosene and stripped with 10N HCl. The stripped solvent was recycled to the extraction section and used again. Most of the hydrochloric acid was evaporated and recovered for re-use. Following ammonia precipitation and filtration of yellow cake the uranium was calcined to an oxide product which was shipped to the Atomic Energy Commission.

The hydrochloric acid uranium stripping agent did not strip scandium, thorium, or titanium from the DDPA solvent. These three elements continued to extract selectively into the organic phase at the expense of uranium loading. The solvent became unable properly to extract uranium, because the exchange sites were progressively filled with non-strippable metals. This effect is known as poisoning of the solvent.

A hydrofluoric acid stripping section was incorporated in the plant to remove thorium and titanium poisons from the solvent. It was later found that the hydrofluoric acid circuit also removed scandium; therefore, a study was initiated to improve recovery of scandium in this section. Laboratory studies with continuous mixer-settlers were used to investigate the fluoride stripping variables such as flow rates, fluoride concentrations, and phase separation rates. These data were scaled up to design size for the mill operation.

For scandium concentrate recovery a portion of the plant-stripped solvent was fed to the hydrofluoric strip section for removal of the poisons. Typical scandium content was less than 0·1 g. per litre Sc_2O_3 in the poisoned organic. The solvent was contacted in a two-stage, counter-current system with an acid fluoride solution to remove scandium and thorium as precipitates and titanium in soluble form. Organic feed rate was 10 gpm., or about one-tenth of the uranium plant organic stream. Aqueous fluoride feed rate was 1 g.p.m., resulting in a 10 : 1 organic to aqueous ratio. The fluoride solution contained 6% fluoride and was adjusted to a pH of 4 with sulphuric acid. Mixer-settlers with adjustable gravity overflows were used for contactors in these solvent-stripping stages. This allowed removal of the fluoride precipitates formed during stripping. After washing with a small amount of water in an additional single mixer-settler stage, the solvent, with poisons removed, was recycled to the uranium extraction section.

The main aqueous stream was filtered to remove the scandium-thorium fluoride cake, yielding a product containing approximately 10% Sc_2O_3 and 20% ThO_2. This concentrate was packaged in drums ready for shipment to the refinining facilities. The filtrate was neutralized with ammonia to precipitate the titanium *plus* a small remaining amount of scandium and thorium. The solids were removed by filtration and stored for possible future recovery. The mother liquor was regenerated with hydrofluoric and sulphuric acids and recycled back to the strip section for further scandium recovery.

Equipment in the strip circuit had the difficult duty of resisting corrosive fluoride solutions and kerosene simultaneously. Saran-lined pipe was used with excellent results for transfer lines. The level-control legs on the mixer-settlers utilized Saran tubing for adjustability. This was much less satisfactory than pipe and had to be replaced periodically. The flexible tubing was most necessary, however, to handle

the slurry formed by precipitation of fluorides in the stripping operation.

Neoprene lining was used in the tanks with fair success, although some deterioration had taken place in less than a year. Neoprene coverings were also used for the plate-and-frame presses.

In general, centrifugal pumps were used to transfer liquids and to feed the presses. Durimet-20 pumps performed well in this installation.

The thorium-scandium cake was shipped to the Chattanooga plant of Vitro Chemical for refining to extremely high-purity scandium oxide. This concentrate exhibited a relatively large amount of radioactivity due to the thorium-230 present in the thorium fraction. As a result, it was necessary to enforce rigid rules of cleanliness and exposure around the filter presses which processed this concentrate. The exposed precipitate, especially immediately after drying, emitted strong beta radiation. This apparently resulted from the isotope thorium-234 which chemically followed the natural thorium. It had a 24½-day half-life and consequently dissipated fairly rapidly with passage of time. Also, strong alpha radiation was exhibited by thorium-230, a product in the uranium radioactive decay chain. It has a much longer half-life (80,000 years), approaching that of radium, and consequently continues alpha emissions with very little attenuation. This presented a lasting hazard when the precipitate was exposed. The alpha-rays were stopped by metal containers such as the 55-gal. drums used for shipping. As a result, no difficulty was experienced in handling the concentrate after it was packaged.

In addition to scandium, it will be noted that this concentrate could provide a source of radioactive thorium isotopes such as thorium-230 (ionium) and thorium-234.

At Chattanooga the crude fluoride cake was digested in a 15% solution of sodium hydroxide for conversion to scandium hydroxide. Metathesis required four hours at temperatures between 75° C. and 90° C. The slurry was filtered in a rubber-covered plate-and-frame-press to remove soluble sodium fluoride and other impurities. The crude hydroxide cake from the filtration was digested in hydrochloric acid and the pH adjusted to four for removal of contaminants by hydrolysis. This was accomplished by heating to 100° C. to precipitate titanium, zirconium, iron, and silica. If large amounts of these elements were present then the hydrolysis cake held considerable scandium and had to be recycled. The filtrate contained scandium, some iron, and uranium. Scandium was recovered from the solution by precipitation with oxalic acid under closely-controlled conditions. For complete recovery it was necessary to use precisely the stoichiometric quantity of oxalic acid with no excess.

The oxalate cake was filtered to remove iron and uranium, then calcined at a relatively low temperature.

Following solution of the scandium oxide in hydrochloric acid a solvent extraction step was used to extract and further purify the scandium chloride solution. The extract was stripped to yield a high-purity scandium solution and ammonia was used to recover the hydroxide. Again, close control was required for complete recovery of scandium. The hydroxide was calcined at 700° C. to produce scandium oxide with a purity greater than 99·5% Sc_2O_3. Further refining has produced products assaying 99·99% Sc_2O_3.

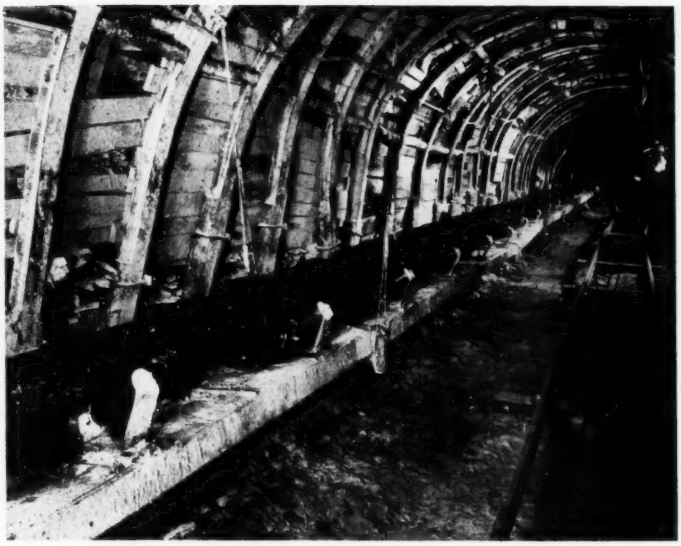
Trade Paragraphs

Visco Engineering Co., Ltd., of Stafford Road, Croydon, which was incorporated in 1921, has changed its name to **Visco, Ltd.** The company are well known for their air filtration, fume removal, dust collection, water cooling, and ventilating equipment.

Neldco Processes, Ltd., of Crossway House, Bracknell, Berks., recently announced that the Sala safety block made by Sala Maschinenfabriks A.B., has been the subject of a special award for outstanding merit by *World Mining*, in their Blue Ribbon series. The safety block was described in the MAGAZINE in January, 1960.

Imperial Chemical Industries, Ltd., of Millbank London, S.W. 1, referring to the accompanying photograph state that this is an example of Terylene-reinforced conveyor belting made by **Leyland and Birmingham Rubber Co., Ltd.,** and in use at Bickershaw Colliery. The N.C.B. have now placed substantial orders. The particular location in the colliery is a gate conveyor in a section of the pit where rock falls and shifting of the conveyor alignment are common.

Hawker Siddeley Industries, Ltd., of Duke's Court, Duke Street, London, S.W. 1, announced recently that the facilities of the Group's two heavy diesel factories, Mirrlees, Bickerton and Day, Ltd., and The National Gas and Oil Engine Co., Ltd., both located in the Manchester area are to be combined into one organization for the production of medium-speed diesel engines. Among export orders current is that



Terylene-Reinforced Conveyor Belting for the N.C.B.

for supplying diesel power equipment for the electrification of Mauritania's iron-ore mines as noted in the MAGAZINE in November last.

Holman Bros., Ltd., of Camborne, Cornwall, announce that they have won another Blue Ribbon award from *World Mining*. This is for their thruster rig which is a guided machine slide that ensures high accuracy in the spacing and direction of holes of up to 30 ft. in depth. Originally produced for long-hole drilling in unfaulted stopes it can be readily adapted for development drilling by using different drill carriages to give a template for correct " Burn Cuts " or " Wedge Cuts." The machines are now at work in Canada, East Africa, Rhodesia, and South Africa, where it was developed. The previous award made last year was for their Rotair rotary screw type compressor.

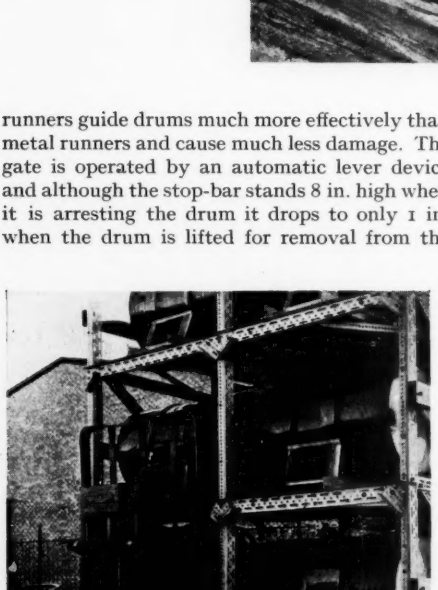
British Ropes, Ltd., of Doncaster, issue some notes from which the following is taken :— The only means of approach to the Braden Copper Mine, 8,000 ft. up on the western slopes of the Andes in Chile, is by a narrow-gauge railway, 42 miles long. The mining camp is built on the side of a mountain. Recently the mining company renewed the wire rope for their bi-cable ropeway which conveys the concentrates from the concentrator to the smelter. This ropeway is four miles long and has two spans, one of 2,500 ft. and the other of 2,000 ft. An order for the new rope has been received by the makers who supplied 3,500 ft. of $1\frac{3}{4}$-in. diameter locked-coil tramway track cable, 3,000 ft. of $1\frac{1}{2}$-in. diameter of the same type of cable, and three lengths, each 16,700 ft. of 1-in. diameter 6 by 21 traction cable.

BTR Industries, Ltd., of Herga House, Vincent Square, London, S.W. 1, state that following negotiations during and after the recent British Trade Fair in Moscow they have been awarded a further major order for conveyor belting of similar construction to those supplied in 1958 and at present in service in the U.S.S.R., the new order for more than five miles of belting being worth over £250,000. This belting, some of which will be over 78 in. wide and of 14-ply construction and up to 1 in. thick, will be used for carrying iron ore and non-ferrous metals and has been designed to meet particularly stringent specifications. It consists of an all " Terylene " carcase with a nylon breaker and with specially compounded rubber covers for operating within a temperature range from 195° F. to − 58° F.

Dexion, Ltd., from their Overseas Division at Wembley, Middx., issue a note on an improved method of storing metal drums in bulk as shown in the illustration. They point out that on-the-roll storage installations have evident advantages in terms of space saving, easier handling, and simpler stock rotation and control (first in first out). The key to the Dexion method is the arrester gate (patents pending in the U.K. and overseas) which cushions the impact of the rolling drum, so reducing damage to the drums and shock to the framework of the rack. Timber

Braden Copper Mine.

runners guide drums much more effectively than metal runners and cause much less damage. The gate is operated by an automatic lever device and although the stop-bar stands 8 in. high when it is arresting the drum it drops to only 1 in. when the drum is lifted for removal from the rack. The need for space-wasting headroom is therefore reduced to a minimum.



F. Taylor and Sons (Manchester), Ltd., of Glazebury, Lancs., (a wholly-owned subsidiary of Steel and Co., Ltd.), and **Richard Sutcliffe, Ltd.,** of Horbury, Wakefield, announce that they have jointly secured the exclusive manufacturing and marketing rights in Great Britain and most countries of the Commonwealth, of the well-known SECOMA mobile drill carriages, bolting platforms, and other mobile mining, quarrying, and tunnelling machines mounted on crawler tracks or pneumatic tyres. The two British companies also share non-exclusive marketing rights in many other countries of the world, excluding France and certain French-speaking territories in which **SECOMA S.A.,** Villeurbanne, France, has retained the exclusive rights to manufacture and sell. Until the British-built machines are available the markets served by these two companies will be supplied from the French factory. In addition to a wide range of standard machines suitable for large and small galleries in the coal, iron, potash, and other mines, the manufacturers are always ready to prepare special designs for individual mine requirements.

Eutectic Welding Alloys Co., Ltd., of North Feltham Trading Estate, Faggs Road, Feltham, Middx., recently held a Press conference to call attention to their activities in all parts of the world in repair welding. For example, Quench Weld is a particular application of eutectic

welding which enables large castings which have been damaged to be welded on site without preheating in approximately one-tenth of the time previously required. At a Cornish tin mine eight of the ten Ni-Resist cast-iron pumpheads on a 10-stage centrifugal pump were cracked and were considered incapable of repair. Replacement would have involved a delay of four to six months and cost £500 per head. The pump was successfully repaired by the Quench Weld process and a shutdown averted. In another case a contractor working on an excavation project had one of his crawler tractors break down in severe weather when mud froze into the sprockets, rollers, and track pad. During attempts to move it the final drive housing broke, the result being a triple-forked jagged break in the metal. The frozen mud was hacked away and Quench Weld effected on the spot, the pieces being built into position one by one after which the tractor was driven out of the excavation.

Johnson, Matthey and Co., Ltd., of 73–83, Hatton Garden, London, E.C. 1, have issued a new data sheet describing their cobalt-platinum permanent magnet alloy Platinax II. This material is the latest development in magnetic alloys of the cobalt-platinum system, and with a $BH_{(max)}$ of $9{\cdot}2 \times 10^6$ gaussoersteds is one of the most powerful permanent magnet materials known. Before its final heat treatment it can be rolled, drawn, or machined without difficulty. As well as general data previously included the new publication gives information on the heat-treatment process, on reversible permeability, and on behaviour at elevated temperatures.

In another announcement the company state that they recently introduced two new resin-encapsulated silvered mica capacitors in the Silver Star range. Two further ones are now available, types C22E and C33E, both of which conform to Class H1 of the British Services' Climatic Specification, for working temperatures in the range -55 to $\pm 125°$ C. The new components are of rectangular section and have tinned phosphor-bronze leads emerging perpendicularly from the base. The leads are suitably spaced for 0·1-in or 0·2-in. module-printed circuit boards and are sufficiently rigid to support the capacitors, but if vibration or acceleration forces in service are high, the capacitor can be cemented in place.

General Electric Co., Ltd., Witton, Birmingham, state that since they marketed their motor-control centre some three years ago many improvements have been incorporated based on service experience. For example, the range of control gear which can be accommodated has been extended to include starters up to 150 h.p. and switch-fuses up to 200 A with no increase in the overall size of the cubicle. A duplex design for installations where floor space is at a premium has also been introduced. In the duplex cubicle the starter trays are mounted on both fronts with a saving of space over two single-fronted cubicles mounted back-to-back. The company's Technical Description No. 445 which describes this class of switchgear has been completely revised and much additional information added.

In another notice they refer to Technical Description No. 315 in which four types of magnetic separators are mentioned : Pulley or drum type, suspension type, chute type, and stand-type swarf separators. Information contained in the previous publication has been brought up to date and particulars of a new range of magnetic separator pulleys have been included. The company have a wide experience in the diverse problems associated with the extraction of magnetic materials from various substances. Witton Kramer electric lifting magnets are dealt with in a 24-page illustrated publication which includes full details of these magnets, together with descriptions of the associated control gear.

Bedford Rock Drill Components, Ltd., of Lion Works, Sheffield, 3, announce that a new company with that name has been set up to produce, for the first time in this country, carburized rods for rock drilling. The business will be started on a site adjacent to the main works of John Bedford and Sons, Ltd., the old-established firm of Sheffield steel manufacturers.

The reason behind the present decision lies in the development over recent years of " long-hole drilling, " which uses heavy specialized machines, frequently drilling to 80 ft. or 100 ft. Sectional drill steels are required, which are made up of a tungsten-carbide detachable bit with screw-thread connexion at the cutting end, a series of sectional rods, and a shank piece. In their notes on this development the company state that one of the pioneers of this type of equipment was the Gardner-Denver Co., of Quincy, Illinois, and Denver, Colorado, who are represented here by Wickman, Ltd., of Nuneaton, Warwicks. The secret of success lies in the use of a carburizing process, which gives deep case hardening of both the outer skin of the rods and shanks and also internal case hardening of the hole down the centre of the bar. The couplings are case hardened on a similar principle. This carburizing process, requiring furnaces of unusual design and considerable knowledge in the application of case hardening

processes, is now to be undertaken by Bedford, under licence from the Gardner Denver Co. The patented Hi-Leed thread, which has been developed by the same American company for the threaded ends of the rods and couplings, will also be used at the Sheffield works. The notes mention also that the results of tests have shown that the performances of drill rods for use with tapered and screw-thread bits of various types treated by this carburizing method is in advance of the conventional drill steels at present manufactured.

NEW BOOKS, PAMPHLETS, ETC.

☛ Publications referred to under this heading can be obtained through the Technical Bookshop of *The Mining Magazine*, 482, Salisbury House, London, E.C. 2.

Minerals for the Chemical and Allied Industries. By SYDNEY J. JOHNSTONE and MARGERY G. JOHNSTONE. Second edition, 1961. Cloth, octavo, 788 pages. Price £7 7s. London : Chapman and Hall.

Rotary Drilling Handbook. By J. E. BRANTLY. Sixth edition, 1961. Cloth, small octavo, 825 pages, illustrated. Price 87s. 6d. New York : Palmer Publications.

Plastic Igniter Cord. Second edition, 1961. Paper folio, 17 pages, illustrated. London : Imperial Chemical Industries, Ltd., Nobel Division.

In the Kirghiz Steppes. By J. W. WARDELL. Cloth, octavo, 190 pages, illustrated. Price 25s. London : The Galley Press.

Summary of Progress of the Geological Survey of Great Britain and the Museum of Practical Geology for the year 1960. Paper covers, 80 pages. Price 5s. London : H.M. Stationery Office.

Report of H.M. Chief Inspector of Mines and Quarries, 1960. Paper covers, 58 pages, illustrated. Price 4s. London : H. M. Stationery Office.

A Bibliography of Cyprus Geology. By L. M. BEAR. Paper folio, 15 pages, typescript. Nicosia : Geological Survey.

The Mining Industry of Southern Rhodesia, 1961. Cloth, quarto, 138 pages, illustrated. Salisbury, Southern Rhodesia : P.O. Box 2880, Seventh Commonwealth Mining and Metallurgical Congress, Southern Rhodesian Section.

The Barium Minerals Industry in Canada. Mines Branch Information Circular IC 126. By J. S. Ross. Paper covers, 60 pages, typescript. Price 25 cents. Ottawa : Department of Mines and Technical Surveys.

Records of the Geological Survey of Nyasaland: Vol. 1—1959. Paper boards, 100 pages, illustrated. Price 15s. Zomba, Nyasaland : Government Printer.

Nyasaland Protectorate : The Geology of the Lake Chilwa Area. Geological Survey Department Bulletin No. 12. By M. S. GARSON. Paper boards, 67 pages, illustrated, with map. Price 12s. 6d. Zomba : Government Printer.

Nyasaland Protectorate : Annual Report of the Geological Survey Department, 1960. Paper covers, 20 pages, illustrated. Price 3s. Zomba : Government Printer.

Fiji : Geology of the Suva Area, Viti Levu (Quarter-degree Sheet No. 20). By P. IBBOTSON. Paper covers, 47 pages, illustrated, with map. Price 12s. 6d. Suva, Fiji : Geological Survey Department.

Fourth Annual Report of the International Tin Council, 1959–1960. Paper covers, 40 pages. Price 7s. 6d. London : International Tin Council.

Non-ferrous Metals and Ferro-alloys (Metallic Non-Ferrosic Ferroleghe) Statistics, 1960. Paper covers, quarto, 160 pages. Milan : Ammi S.p.a.

RECENT PATENTS PUBLISHED

☛ A copy of the specification of the patents mentioned in this column can be obtained by sending 3s. 6d. to the Patent Office, Southampton Buildings, Chancery Lane, London, W.C. 2, with a note of the number and year of the patent.

211 of 1957 (874,432). FULLERS EARTH UNION, LTD. Treatment of clay.

25,550 of 1957 (874,433). CIBA, LTD. Preparation of electrolytic baths for the production of niobium or tantalum by the electrolysis of melts.

25,690 of 1957 (873,844). CIBA, LTD. Production of niobium or tantalum by the electrolysis of melts.

28,322 of 1957 (876,668). THIELE KAOLIN CO. Clay and a means of increasing its brightness.

32,115 of 1957 (876,856). SHERRITT GORDON MINES, LTD. Separation of nickel from cobalt.

39,959 of 1957 (876,802). CIBA, LTD. Reduction of the double salts of niobium or tantalum pentahalides.

41,516 of 1958 (875,895). METALLGESELLSCHAFT A.G. Continuous sinter and roasting apparatus.

21,327 of 1959 (875,539). ASSOCIATED ELECTRICAL INDUSTRIES, LTD. Production of beryllium.

4,006 of 1960 (874,785). SHELL INTERNATIONALE RESEARCH MAATSCHAPPIJ N.V. Preparation of agglomerates of pulverized ores.

8,316 of 1960 (874,389). BAHCO A.B. Centrifugal wind classifiers.

8,731 of 1960 (874,573). GUILINI G.M.B.H. Treating of ores.

Selected Index to Current Literature

This section of the Mining Digest is intended to provide a systematic classification of a wide range of articles appearing in the contemporary technical Press, grouped under heads likely to appeal to the specialist.

* Article in the present issue of the MAGAZINE. † Article digested in the MAGAZINE.

Economics

Gasification, Coal : *Research, United States.* Underground Gasification of Coal : Operation of a Multiple-Path System. J. P. CAPP and others, *Rep. Inv. U.S. Bur. Min.* 5830.

Production, Canada : *Barium Minerals, Survey.* The Barium Minerals Industry in Canada. J. S. Ross, *Canad. Mines Branch Inform. Circ.* I.C. 126.

Production, Canada : *Gold, B.C.* The Historic Cariboo. *Western Miner,* July, 1961.

Production, United Kingdom : *Ball Clay, Devon.* Potters' or Ball Clay Mining in South Devon. W. J. BLOORE, C. L. BOOTH, *Min. Engr.*, Aug., 1961.

Resources, United States : *Iron, Western.* A Look at Western Iron—Today. *Engg. Min. J.*, Aug., 1961.

Geology

Coals, United States : *Content, Beryllium.* Beryllium Content of American Coals. T. STADNICHENKO and others, *U.S. Geol. Surv. Bull.* 1084-K.

†**Economic, Africa :** *Copper, Transvaal.* Phosphates and Copper in N.E. Transvaal. *S. Afr. Min. Engg. J.*, Aug. 4, 1961.

Economic, Africa : *Gold, S. Rhodesia.* Gold Prospecting in Southern Rhodesia. A. A. T. MEHLISS, I. GOLDBERG, *Rhod. Min. Engg.*, July, 1961.

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